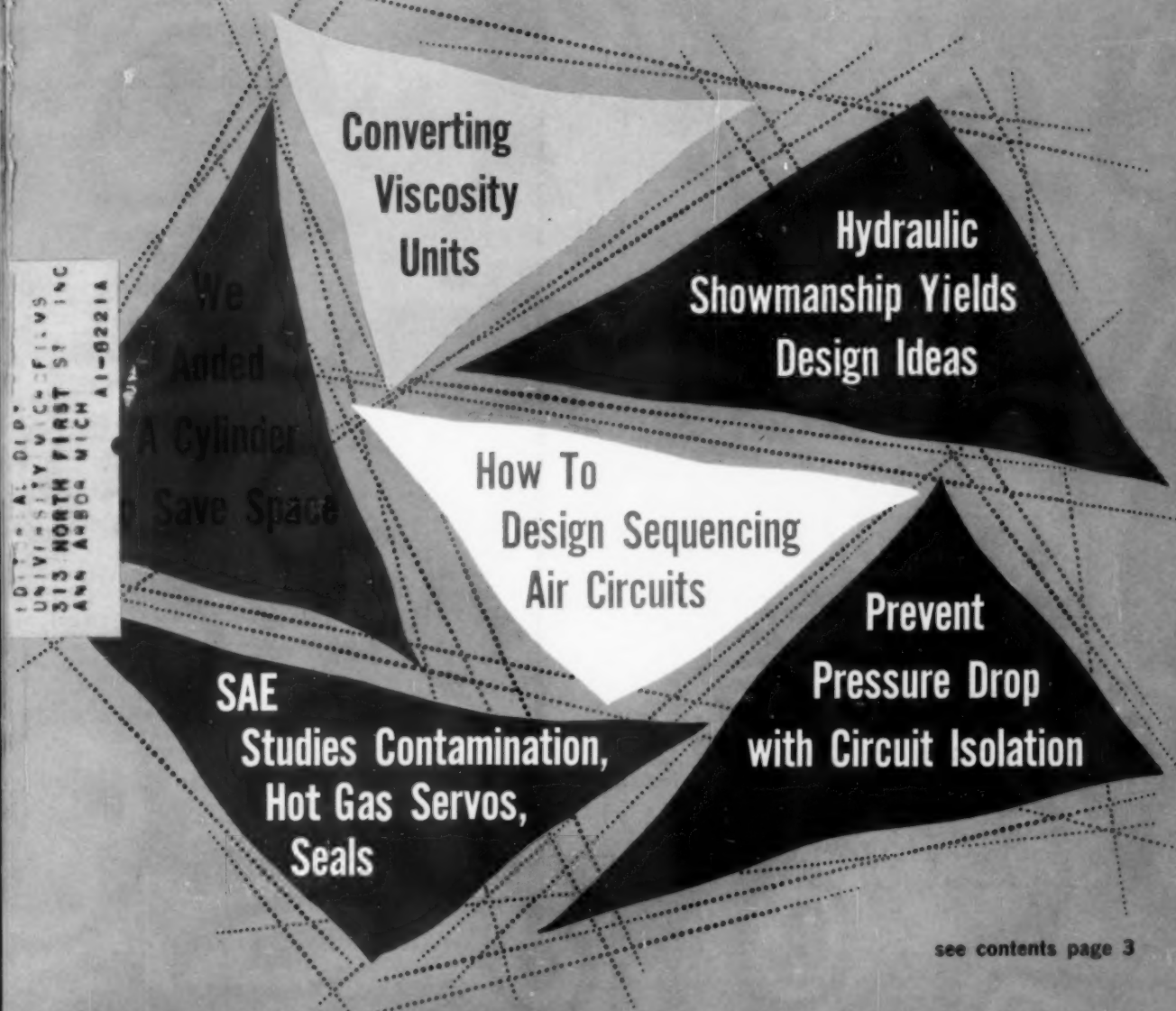
Hydraulics & Pneumatics

JULY 1960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see contents page 3

THE MAGAZINE OF FLUID POWER

AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

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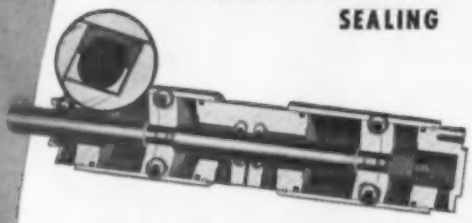

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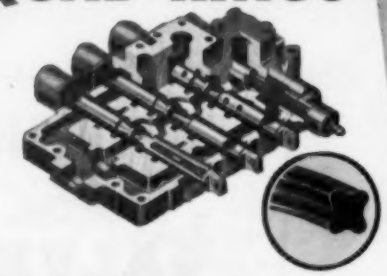

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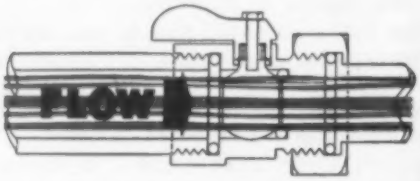

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Hydraulics & Pneumatics

VOLUME 13/NUMBER 7

JULY 1960

THE MAGAZINE OF FLUID POWER

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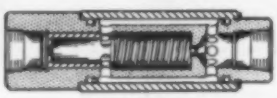

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ANCHOR INTRODUCES NEW DISTRIBUTOR CATALOG

In line with its new and broader distributor policy, Anchor Coupling Co. Inc. has recently issued a new Catalog D-1, exclusively for distributor circulation, that covers the entire Anchor Reusable Hydraulic Coupling, Hose and Fitting line that is available to users through Anchor's distributor organization.

This expanded distributor operation is designed to provide a quicker, more convenient service for the present and potential users of Anchor Couplings and Fittings. Distributors are carrying a complete stock of Reusable Couplings, Hose, Adapter Unions, Adapters, Pipe Fittings, SAE Boss Fittings and SAE 4-Bolt "O" Ring Flanged Head Couplings that can be made quickly available as required by local customers, both as parts or in hose assemblies.

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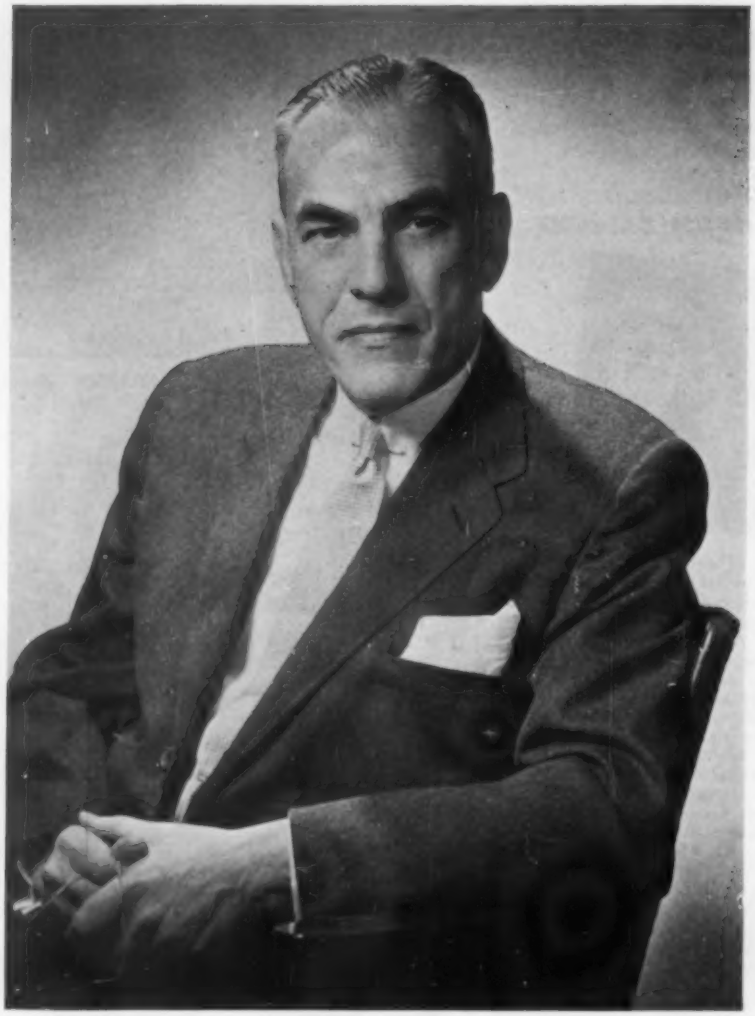

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1897-1960

Founder, The Industrial Publishing Corporation

ONCE YOU MET IRVING HEXTER, you remembered him. He didn't leave neutral impressions. He probably was never neutral about anything in his life. He reacted strongly to things, responded warmly to people—and they to him. He devoted nearly as much effort to people as he did to the publishing firm he founded. Scores of worthy causes asked his help. None was ever refused. His great labor of love was the American Heart Association. He served it as a national officer for years, was the third layman ever to win its Gold Heart Award. He established and endowed a laboratory for heart disease research.

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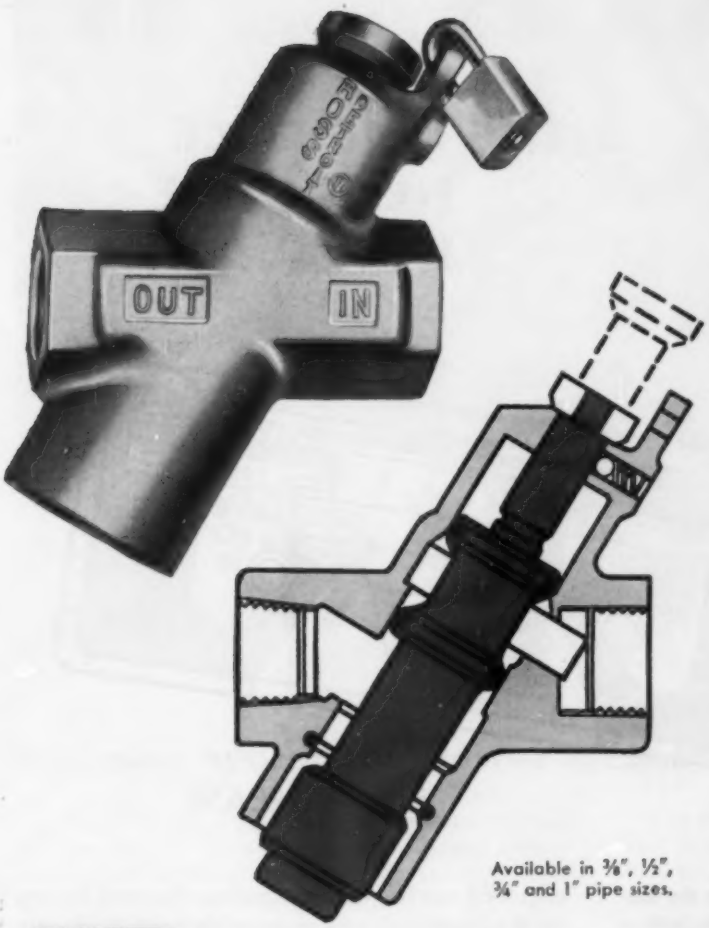
Lock out air for machine repair



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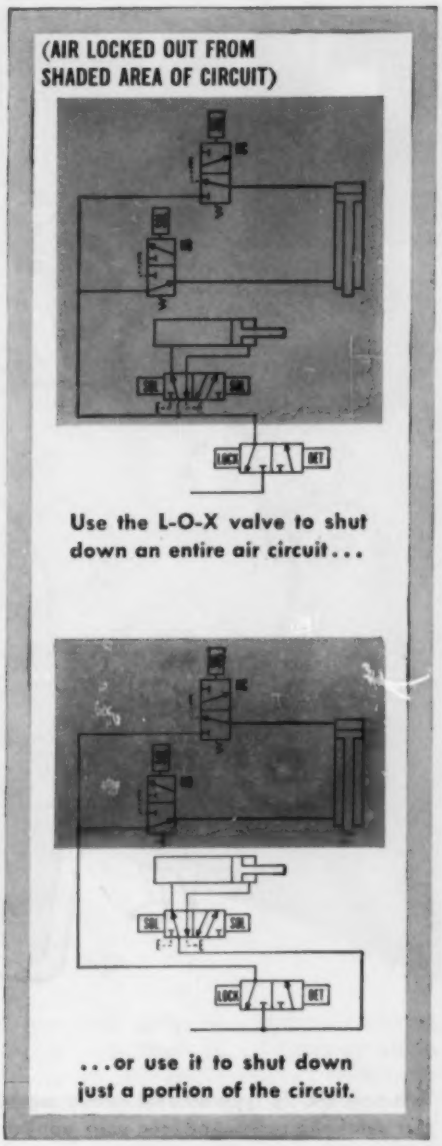
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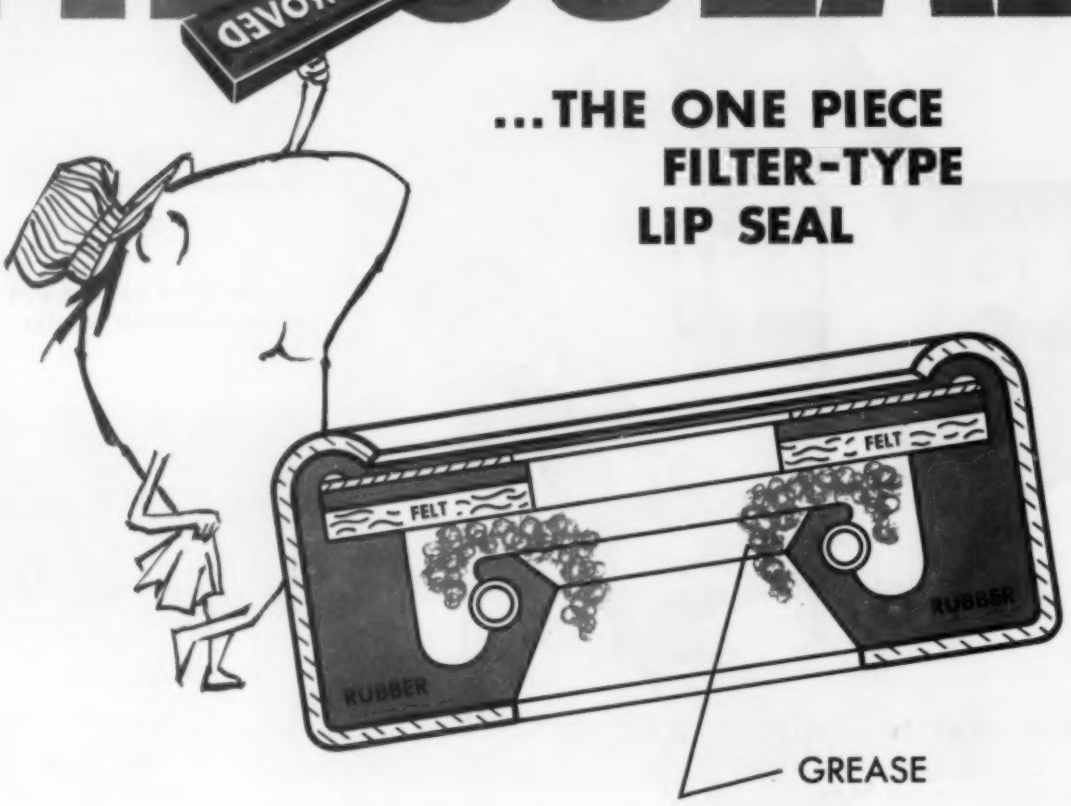

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P1

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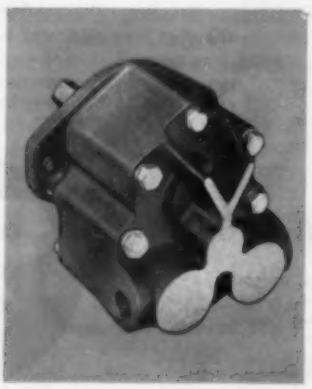
Would a Webster hydraulic motor, pump or valve adapt to your product? Would it solve a power transmission problem? There's one way to find out — ask the advice of a specially trained Webster hydraulics engineer. There's no obligation. Write for action!



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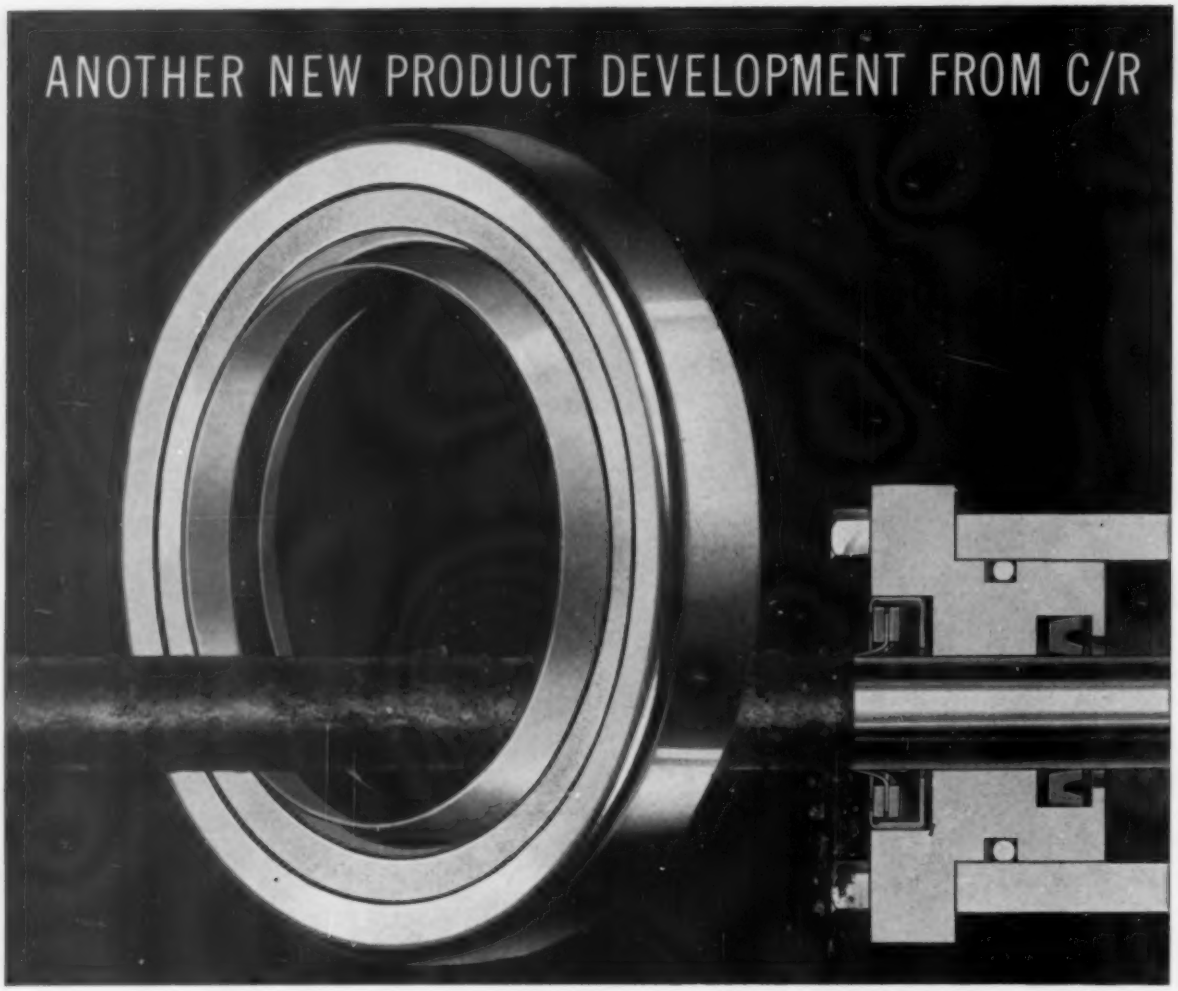
WEBSTER ELECTRIC

RACINE · WIS



New Wiper-Scraper Seal for Cylinders

Scrapes off ice, mud, tar – wipes off water, dust, other contaminants

Now, you can effectively exclude dirt and other contaminants from hydraulic cylinders under the most severe field conditions. One compact unit, the C/R SC Wiper-Scraper Seal does the job. Formerly, a separate rod scraper had to be installed in front of the ordinary wiper seal. The special machining necessary, plus the scraper ring, and retaining ring made this an expensive installation.

Chicago Rawhide's SC Wiper-Scraper Seal combines a spring brass scraper and synthetic rubber wiping member in one steel shell. The I.D. of the scraper is slightly under shaft size to provide a snug fit that will remove tar or frozen mud, but it has sufficient play within the shell to tolerate any off-center conditions of the rod such as caused by bearing "bore-slop." The cost is much lower than any other combination of scraper and wiper. "Design-in" cost is low, assembly simple. Most important is the performance contribution to the cylinder. The additional value of longer packing life and increased operating dependability with the SC Wiper-Scraper Seal will far outweigh the nominal cost.

For complete information, specifications and standard sizes, write for your copy of C/R's new Bulletin SC-100

CHICAGO RAWHIDE MANUFACTURING COMPANY

C/R

OIL SEAL DIVISION: 1203 ELSTON AVENUE • CHICAGO 22, ILLINOIS
Offices in 55 principal cities. See your telephone book.
In Canada: Chicago Rawhide Mfg. Co. of Canada, Ltd., Brantford, Ontario
Export Sales: Geon International Corp., Great Neck, New York
C/R Products: C/R Shaft & End Face Seals • Sirvene (synthetic rubber) molded pliable parts
Sirvis-Conpor mechanical leather cups, packings, boots • C/R Non-metallic Gears.

Circle **33** on Time-Saver Card

Circle **98**

...Fluid Power News

REPORT NO. 11,802 AUTOMATIC METALS BRIQUETTING PRESSES

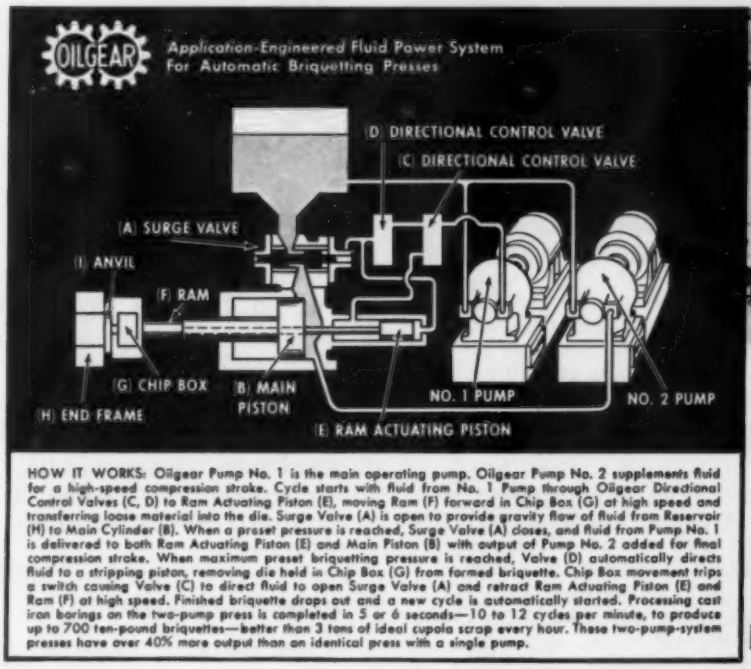
From Oilgear *Application-Engineering* Files

HOW OILGEAR-EQUIPPED BRIQUETTING PRESSES PRODUCE MORE—LONGER—AUTOMATICALLY

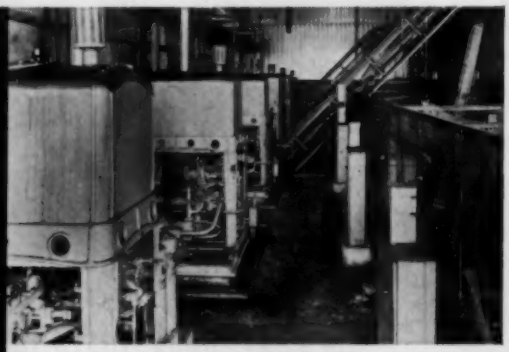
CUSTOMER: *Milwaukee Foundry Equipment Division of SPO Inc.*

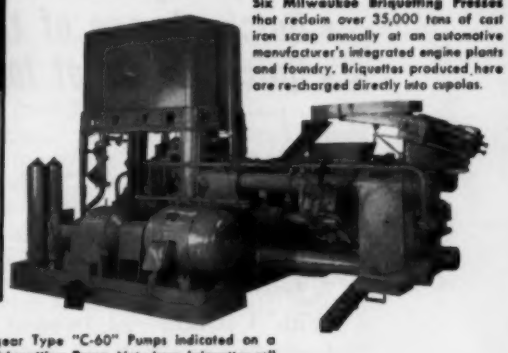
DATA: To power a line of presses specially designed for low cost, rapid conversion of bulky, low-grade metal turnings and borings into dense, uniform-sized briquettes to: conserve storage space; simplify handling; prevent storage oxidation—particularly with finely divided metals or sponge iron; provide sufficient density and size to melt rather than flash into oxide on entry into foundry cupola; control metal content; provide a simple means of accurate compounding for alloying or supplying a flux.

PRESS SYSTEM REQUIREMENTS: 1. Eliminate wear and maintenance costs resulting from use of gears and bearings. 2. To be controlled hydraulically, electrically, or electrohydraulically for automatic cycling at rates ranging from 9 to 17 strokes per minute. 3. Sufficient force to provide briquette densities of 70 to 80% with conservative pump loading. 4. Long life, rugged dependability . . . capable of years of continuous operation with an absolute minimum of maintenance.



HOW IT WORKS: Oilgear Pump No. 1 is the main operating pump. Oilgear Pump No. 2 supplements fluid for a high-speed compression stroke. Cycle starts with fluid from No. 1 Pump through Oilgear Directional Control Valves (C, D) to Ram Actuating Piston (E), moving Ram (F) forward in Chip Box (G) at high speed and transferring loose material into the die. Surge Valve (A) is open to provide gravity flow of fluid from Reservoir (H) to Main Cylinder (B). When a preset pressure is reached, Surge Valve (A) closes, and fluid from Pump No. 1 is delivered to both Ram Actuating Piston (E) and Main Piston (B) with output of Pump No. 2 added for final compression stroke. When maximum preset briquetting pressure is reached, Valve (D) automatically directs fluid to a stripping piston, removing die held in Chip Box (G) from formed briquette. Chip Box movement trips a switch causing Valve (C) to direct fluid to open Surge Valve (A) and retract Ram Actuating Piston (E) and Ram (F) at high speed. Finished briquette drops out and a new cycle is automatically started. Processing cast iron borings on the two-pump press is completed in 5 or 6 seconds—10 to 12 cycles per minute, to produce up to 700 ten-pound briquettes—better than 3 tons of ideal cupola scrap every hour. These two-pump-system presses have over 40% more output than an identical press with a single pump.





Six Milwaukee Briquetting Presses that reclaim over 35,000 tons of cast iron scrap annually at an automotive manufacturer's integrated engine plants and foundry. Briquettes produced here are re-charged directly into cupolas.

One of the two Oilgear Type "C-60" Pumps indicated on a 350-ton **Milwaukee Briquetting Press.** Note how briquettes roll out of the press to be picked up by magnets.

SOLUTION: Oilgear *Application-Engineered* systems consisting of Oilgear Type "C" Heavy-Duty Constant Displacement Radial Rolling Piston Pumps and Directional Control Valves. Pump requirements range from 23 gpm on the 75-ton Presses to 325 gpm on new 1000-ton presses. *Milwaukee Foundry Equipment*—builder of over 80% of all briquetting presses, and an exclusive user of Oilgear Fluid Power Systems since 1927—recently reported: "*We just modernized a press that had been in continuous cast iron briquetting operation for over 18 years . . . there had been no reported major maintenance . . . the Oilgear components still operated fine—with no appreciable signs of wear or loss in efficiency.*"

This is just one evidence—out of hundreds—of the long service life of Oilgear Systems. Ten or more years of continuous service is common with Oilgear equipment, rather than the exception . . . with many of these systems operating under adverse conditions—rapid cycling, grit-laden air, heat, and extreme humidity. Where the going is toughest—Oilgear Pumps just keep rolling along . . . quietly, efficiently.

With Oilgear Heavy-Duty System Components designed for thousands of hours of continuous service at full rated load, savings are compounded with every hour of uninterrupted performance. That's why machinery and equipment manufacturers and *their* customers say . . .

"for the lowest cost per year . . . it's Oilgear!"

For solutions to YOUR linear or rotary Controlled Motion problems, call the factory-trained Oilgear Application-Engineer in your vicinity. Or write, stating your specific requirements, directly to . . .

THE OILGEAR COMPANY

Application-Engineered Controlled Motion Systems

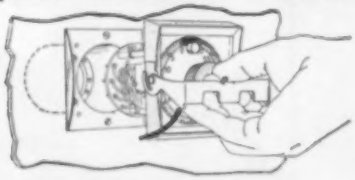
1564 WEST PIERCE STREET • MILWAUKEE 4, WISCONSIN

Phone: Mitchell 5-6715 . . . Direct Distance Dialing Code 414

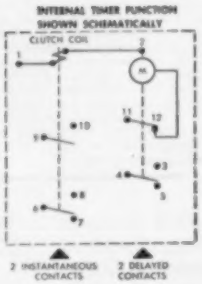
new plug-in timer
for controlling industrial processes
EAGLE'S HP5 CYCL-FLEX

Offers:

- Fast, easy installation
- Quick change of time ranges
- Quick means of localizing trouble



To Remove: Lift handle and pull out



With 4 switches—2 switches operate instantly when timer is energized—2 switches operate with time delay—delay time adjustable—selection of dials from 10 seconds to 60 hours. Write Dept. AH-760.

VISIT US AT THE
PRODUCTION ENGINEERING SHOW
SEPT. 6-16 1960
NAVY PIER, CHICAGO
BOOTH NO. 381

EAGLE SIGNAL COMPANY
Moline, Illinois

The Most Complete Line of Time-Count Controls

Circle 44 on Time-Saver Card

LETTERS
to the editor

Address your letters to: Editor, HYDRAULICS & PNEUMATICS MAGAZINE, 812 Huron Rd., Cleveland 15, Ohio.

Needs air turbine motor

TO THE EDITOR:

In the September 1957 issue of APPLIED HYDRAULICS & PNEUMATICS you published an article on rotary air motors. Of particular interest to me is the short section you devoted to turbine motors. At present we are investigating the possibility of using such a motor in the 60,000 rpm range with a power output of under ½ hp.

Being unfamiliar with the field of air turbine motors, I hope you can provide me with informational sources for the design of this type of motor. Any sources for air turbine motors, particularly for aircraft use will be appreciated.

JULES A. MEYLAN
Design Engineer
Norden
Division of United Aircraft Corp.
White Plains, New York

We regret that we cannot suggest a source for an air motor of 60,000 rpm and ½-hp output. On page 130 of the January 1960 APPLIED HYDRAULICS & PNEUMATICS *issue you'll find a chart for air motors. Surveying these companies may be helpful. Perhaps one of our readers can suggest an air motor source.*

Wants flow charts

TO THE EDITOR:

We would appreciate hearing from you if you can furnish us two hydraulic flow charts. The ones we have seen show in the left hand column, flow in gpm. On the lower left hand portion of the drawing it shows inside pipe diameter. On the right half lower part it shows viscosity, and on the right hand side of the drawing it shows psi loss per foot of pipe length.

The size of the drawing we have in mind is approximately 18"x30".

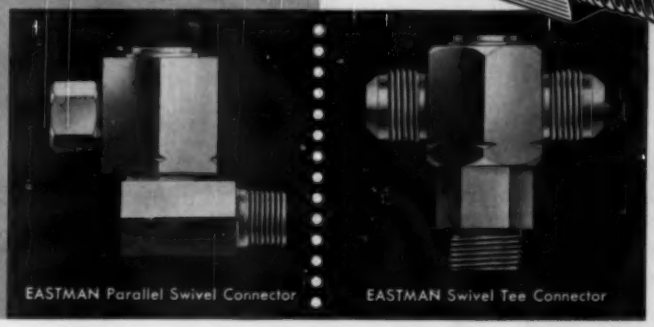
Continued on page 16

Eastman
improves INDUSTRIAL SWIVEL CONNECTOR

Licensed Under
Pat. No. 2481404

AMAZING VERSATILITY AND ADAPTABILITY!

These two adaptations, specified by two of America's largest major equipment manufacturers, reveal the unique adaptability and versatility of EASTMAN'S improved Industrial Swivel Connector.



EASTMAN Parallel Swivel Connector — EASTMAN Swivel Tee Connector

improves **SEALING QUALITY**
through use of SIX seals, thereby eliminating failure from grit, dust and other foreign materials.

improves **SERVICE LIFE**
through new design and engineering, the interior is chrome-hardened with a highly polished mirror finish.

improves **UNIFORMITY OF FLOW**
at any angle of the swivel by undercutting the shaft to equal diameter of the orifice.

improves **SERVICEABILITY**
through shorter, more compact housing; saving weight. Hex design permits multiple tapping on housing; easier assembly.

While the use of EASTMAN'S High Pressure Industrial Swivel Connector eliminated the cause of hose failure due to constant, extreme flexing, it tended to increase the load on the swivel connector.

To improve the performance of the swivel itself, EASTMAN engineers improved its internal design, chrome-hardened its interior surfaces, cadmium plated the shaft and then machined them to a mirror-like finish.

Satisfactory service under the most unfavorable field conditions was insured by increasing sealing rings from four to SIX: 2 leather dust seals, 2 synthetic back-up washers and 2 quad rings of oil-resistant rubber (−65° to +250°).

Exhaustive tests at 3000 p.s.i., through one million cycles, with the hydraulic fluid *saturated* with abrasives, dirt and other foreign materials, proved EASTMAN'S Industrial Swivel Connector satisfactory in every respect and did not cause failure of any kind.

That is why America's leading OEM's and replacement buyers specify *complete* EASTMAN Hydraulic Hose Assemblies . . . for improved design, quality manufacturing and exhaustive testing. It pays to specify EASTMAN.

STANDARD SIZES AND COMBINATIONS AVAILABLE

LOW TORQUE—Freedom from friction, even under high pressure.

WIDE RANGE—Operating pressures up to 5000 p.s.i. trouble-free operation through wide temperature range (−65° to +250°).

ROTATION—Full 360° for all manifolds.

SIZES—Steel, plated for corrosion protection—½", ⅜", 1", 1¼".

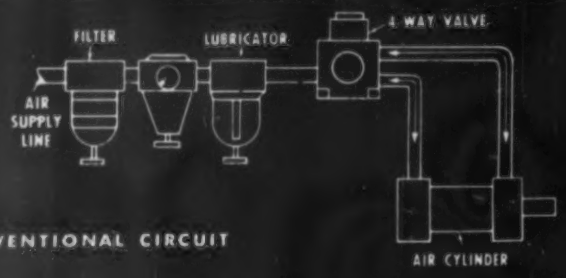
Other sizes available on request.

Eastman MANUFACTURING COMPANY
DEPT. AH-7, MANITOWOC, WISCONSIN

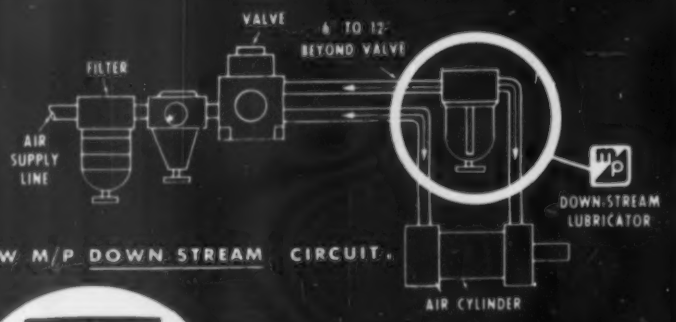
LOOK INTO EASTMAN'S IMPROVED SWIVEL CONNECTOR—WRITE TODAY!

Please send me Bulletins 100 and 200 on low, medium and high pressure assemblies.

NEW M/P CONCEPT
OF AIR CYLINDER LUBRICATION



CONVENTIONAL CIRCUIT



NEW M/P DOWN STREAM CIRCUIT.

DESIGNED SPECIFICALLY FOR AIR CYLINDERS

With a conventional circuit the air cylinder may not be lubricated because oil introduced by the lubricator is trapped in the valve and exhausted to atmosphere. Any small amount of oil that works through the valve may also be exhausted when the cylinder is reversed.

Now . . . M/P has developed a new concept of air cylinder lubrication. The new Lubricator (Model M204) installed in the *Down-Stream Circuit* assures lubrication of both the control valve and the cylinder.

Contact your local representative or M/P for a detailed brochure.

HYDRO-JECTOR
Automatic drain valve that can be installed easily in the bottom drain port of any compressed air filter, drain leg or surge tank.

SHATTER-GUARD
A new feature which makes the M/P *Visi-Bowl* as safe as a metal bowl. Available on all M/P Filters, Lubricators and *Hydro-Jectors*.

MASTER PNEUMATIC, INC.
20430 SHERWOOD • DETROIT 34, MICHIGAN • Phone: TWinbrook 3-7070

Circle 89 on Time-Saver Card

LETTERS

We would appreciate any information you can give us regarding this table.

A. F. WOOLSEY
84 Madison Street
Seattle 4, Washington

On page A/63 of the FLUID POWER DIRECTORY *is a nomograph relating to viscosity, flow rate, pressure loss, and tubing bore. This may satisfy your requirement for a reference to make quick calculations.*

Fluid Power Handbook

TO THE EDITOR:

We would like your suggestions as to a good handbook relating to air and hydraulic systems. We assume that you would suggest a separate book to cover pneumatics and hydraulics, and since you work so close to publications of this nature, we though you could suggest publications which would best suit general requirements on air and hydraulics.

R. J. LIPP
Sales-Order Dept.
R. C. Neal Company, Inc.
Buffalo, N. Y.

Our first thought of course is the FLUID POWER DIRECTORY. *In the January 1960 issue of* APPLIED HYDRAULICS & PNEUMATICS, *we compiled a list of current textbooks on fluid power.*

Plastic Lines Application

TO THE EDITOR:

We have noticed on page 70 of your April 1960 magazine one of the Production Feeder Corporation's feeders, and as we would be interested in them, be so kind and let us have by return air mail their full address to enable us to request full details of their production feeders.

PAOLI PALLOTTI
13 Via G. B. Pergolesi
Milan, Italy

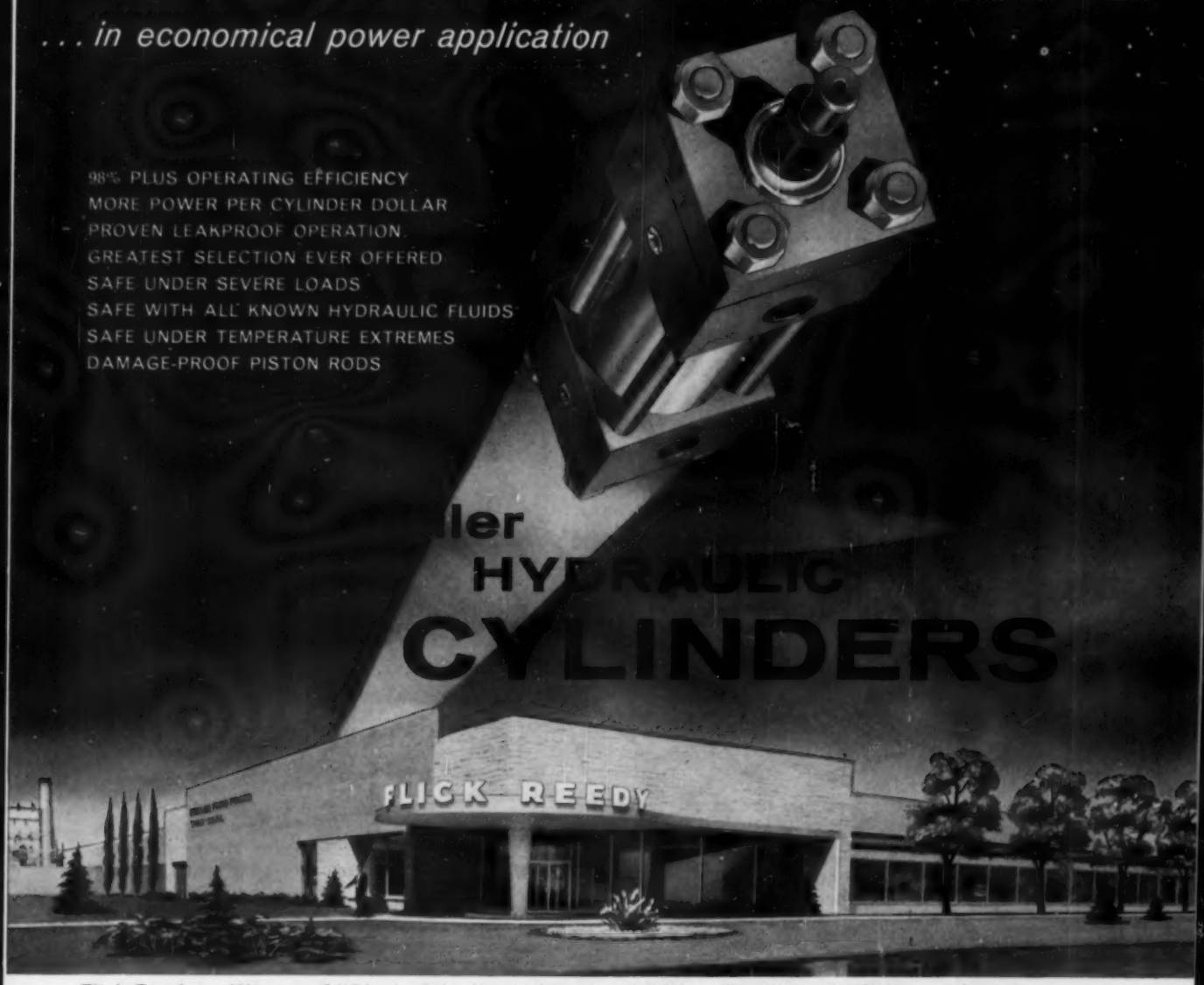
We have forwarded your request to Production Feeder Corp.

Circle 92

OPENING NEW HORIZONS

. . . in economical power application

98% PLUS OPERATING EFFICIENCY
MORE POWER PER CYLINDER DOLLAR
PROVEN LEAKPROOF OPERATION
GREATEST SELECTION EVER OFFERED
SAFE UNDER SEVERE LOADS
SAFE WITH ALL KNOWN HYDRAULIC FLUIDS
SAFE UNDER TEMPERATURE EXTREMES
DAMAGE-PROOF PISTON RODS



ller
HYDRAULIC
CYLINDERS

Flick-Reedy . . . *Winner of "Plant of the Year" Award and "Silver Anvil" Public Relations Award*

Miller

MORE SAVINGS!

Our ultra-modern, new "Plant of the Year" with its special facilities and operating economies enable us to offer an **extra 10% price savings** on our big "stock" selection of:
Model "H" (Hyd.) Cylinders, 1½" through 8" bores;
Model "J" (Hyd.) Cylinders, 1½" through 14" bores;
Model "A" (Air) Cylinders, 1½" through 14" bores.
Strokes up to 36", cushioned and non-cushioned.

Full Details On Request

Miller Hydraulic Cylinders make impossible applications look easy. With Teflon Seals, Case-Hardened Rods (50-54 Rockwell C), Patented "Shef" Tubing End Seals, and other exclusive *standard* features, these cylinders are practically damage-proof, are ultra-dependable under pressure and temperature extremes, and provide leakproof sealing with ALL hydraulic fluids. Built to *exceed* J. I. C. Specifications, these cylinders are achieving new highs in production and operating economies in thousands of plants. Two great lines: Power-Packed Model H for 3000-5000 psi and Job-Rated Model J for 500-2500 psi. All bores, strokes and mounting styles. Big "Stock" selection for immediate shipment at substantial savings.

Write for literature.

R

MILLER FLUID POWER

DIVISION OF [illegible] CORPORATION

7N017 York Road, Bensenville, Illinois

AIR AND HYDRAULIC CYLINDERS · ACCUMULATORS
COUNTERBALANCE CYLINDERS · BOOSTERS

VERSATILE...
LOW
COMPRESSION
SET
NEOPRENE
TECHNICAL MEMO ON LINEAR COMPOUNDS
7354-70 and 7309-85
—outstanding for O-rings; adaptable to U-cups, V-rings and other sealing designs.
• Neoprene with low compression set properties
• High resistance to wear
• Low gas permeability—advantageous for use in oxygen, carbon dioxide and gaseous fuels
• Effective sealing from −40°F to +225°F
FLUIDS COMPATIBLE WITH THESE COMPOUNDS
Acetic Anhydride • Acetonitrile • Amyl Alcohol • 1-Butene • Butter • Butyl Alcohol • Butyric Acid • Castor Oil • Diacetone Alcohol • Ethyl Alcohol • Ethylene Glycol • Ferric Chloride • Fluorolube GR-362 • Fluorolube GR-544 • Freon 12 • Freon 13 • Freon 22 • Freon 114 • Freon 115 • Formaldehyde • Furfuryl Alcohol • Glycerine • Hydrochloric Acid (dilute) • Isopropyl Alcohol • Larex • Lard • Methyl Alcohol • Methyl Cellosolve • Milk • MIL-L-17331 • Mobil Nyvac #20 • Nitric Acid (dilute) • Olive Oil • Pinene • Sea Water • Sulfuric Acid (dilute) • Tellus #33 • Triethanolamine • Tung Oil • Ucon Lubricants • Wagner Brake Fluid
For complete technical data—including list of incompatible fluids—request Bulletin 56707-1. Linear, Inc., State Road and Levick St., Philadelphia 35, Pa.
PERFECTION IN RUBBER
LINEAR
LINEAR Inc. STATE ROAD & LEVICK ST. PHILA. 35 PA

FLUID POWER FORUM

Each month HYDRAULICS & PNEUMATICS surveys readers for their experiences and opinions in fluid power design.

• *JIC Standards now approve welded tubing. How will this affect your designs for cylinder and lines?*

At present, we don't think that using welded tubing will change our circuitry designs. According to a steel salesman with whom I talked a few weeks ago, the welded tubing can be worked in the same manner as the seamless type.

If we can bend the welded tubing to the same radii and use standard self-flaring fittings for hooking it up, then I can see no reason for changing any method of circuitry design.

O. ANDREWS
Franklin Electric Company
Bluffton, Indiana

JIC approval may be o.k., but the use of welded tubing in cylinders and lines always raises numerous questions in the minds of design engineers. Typical questions that must be answered are as follows:

1) Metallurgy of the welded joint?
2) Surface finish of the inside diameter of the tube?
3) Dimensional control?
4) Cold-working of the weld when bending or flaring?
5) Contamination of the base metal by the welding process?
6) Cost?
7) Inspection?
8) Limitations on materials of construction to assure good welds?
9) Joint efficiency?
10) Suppliers?
11) Sizes available?
12) Pressure limitations?

The answers to these questions must be available before the designer can make a selection or choice.

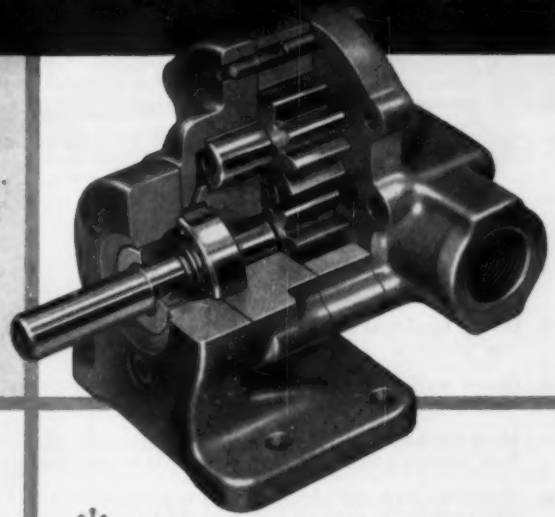
P. B. MOORE
Lockheed Electronics Co.
Plainfield, New Jersey

Continued on page 20

ADEL...offers you *single source* responsibility

for precision hydraulic power pumps

CONSTANT DISPLACEMENT GEAR TYPES WITH ELEVEN DIFFERENT GALLONAGE OUTPUTS... DESIGNED FOR 1000 PSI SERVICE WITH RATED CAPACITIES OF FROM 1.4 TO 47.5 GPM AT 1800 RPM



Precision-built for long, trouble-free service under the most severe operating conditions, they exceed the requirements for a low cost, efficient power source. Highest volumetric and hydraulic efficiency—rugged simplicity—only two moving parts—the impeller assemblies, which roll together with minimum wear and horsepower loss.

- **Pumps operate at higher speeds than most competitive units and permit use of smaller pumps and motors for a given horsepower requirement, thus reducing initial cost.**
- **The unusual drive design of the impeller gear minimizes wear between the gear and end plates. Pumps are self-lubricated. No grease fittings to service and no external drain required.**
- **Special shaft seal assures positive sealing, eliminates packing difficulties. Precision gear type construction makes a quieter operating pump. Ratio of volume output to pump size unusally high.**

The Pumps With Maximum Operating Efficiency Over The Years
Let ADEL be your **single-source** *for* **precision hydraulic equipment**
Write for pump brochure containing complete specifications.

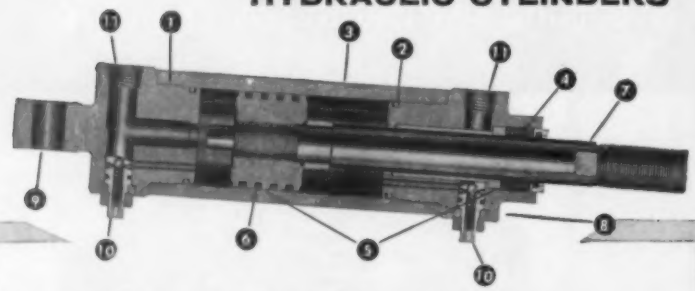
NEW DIMENSIONS IN reliability **ADEL** PRECISION PRODUCTS

Designers and Manufacturers of
INDUSTRIAL & MARINE
HYDRAULIC CONTROL EQUIPMENT

A DIVISION OF GENERAL METALS CORPORATION
1444 WASHINGTON AVENUE,
HUNTINGTON 4, WEST VIRGINIA
DISTRIBUTORS IN PRINCIPAL CITIES
THROUGHOUT THE U. S. AND CANADA

You get ALL 12 only with *Pathon*

HYDRAULIC CYLINDERS



1. Heads retained with a single screw thread for maximum strength, rigidity and minimum size.
2. O-ring head seal in close fitting pilot. Long Pilot maintains concentricity.
3. Heavy wall seamless steel tubing for strength *allows generation of precision bores.*
4. Multi-lip packing for longer life — *externally replaceable.* Rod bearing inboard to packing where it gets *lubrication.*
5. Relatively long span between piston and rod support *resists side loads with reduced unit bearing force.* This eliminates need for "stop tubes" even on long stroke cylinders.
6. Either standard ring type or U-cup type piston available. Both may be *readily installed without special tools* or collapsing devices.
7. Hard chrome-plated piston rod standard. Hardened and chrome-plated alloy steel rods, ground after *hardening for straightness,* optional.
8. Minimum mounting area required on all end mounted units.
9. Integral mounting pads for *rigidity* and permanence. No welding, no brackets.
10. Cushion adjustment requires only 180° turn from full open to full closed. *Makes setting cushions easy.* Equipped with locking nut. *No change of position after setting.*
11. Ports may be located in *any position* relative to each other.
12. No *tie-rods* to *stretch,* or tie-rod *nuts* to *coin* into the *heads* under heavy loads.

Pathon Hydraulic Cylinders are available in nine mounting types, thirteen bore sizes—1⅛" through 14", and three Series—for 1,000, 2,000, 3,000.

WRITE FOR BULLETIN 22A P.S.I.

Pathon

MANUFACTURING COMPANY

3823 PACIFIC AVE., CINCINNATI 12, OHIO

FLUID OPERATED AND CONTROL EQUIPMENT

Circle **104** on Time-Saver Card

FORUM

We now use welded tubing lines for pressures up to 20,000 psi. We would not use it for pressures above 20,000 psi. (Our equipment operates up to 100,000 psi.) Our cylinders could very well be made from welded tubing since they are pressurized to only 250 psi.

Is there any published information on pumping at pressures above 60,000 psi?

LEE R. REED
Engineer
Lee Tool & Instrument Co.
Houston 23, Texas

● *Are you using straight-thread tube and hose fittings? Do these seal with an O-ring or a metal-to-metal fit? What are the advantages you've gotten with them? If you're not using them now, are you planning to in the future?*

We have used straight-thread tube fittings with O-ring in the past. At present we are in the process of new products which will use the same type of fittings. Advantages: better sealing, fewer leaks.

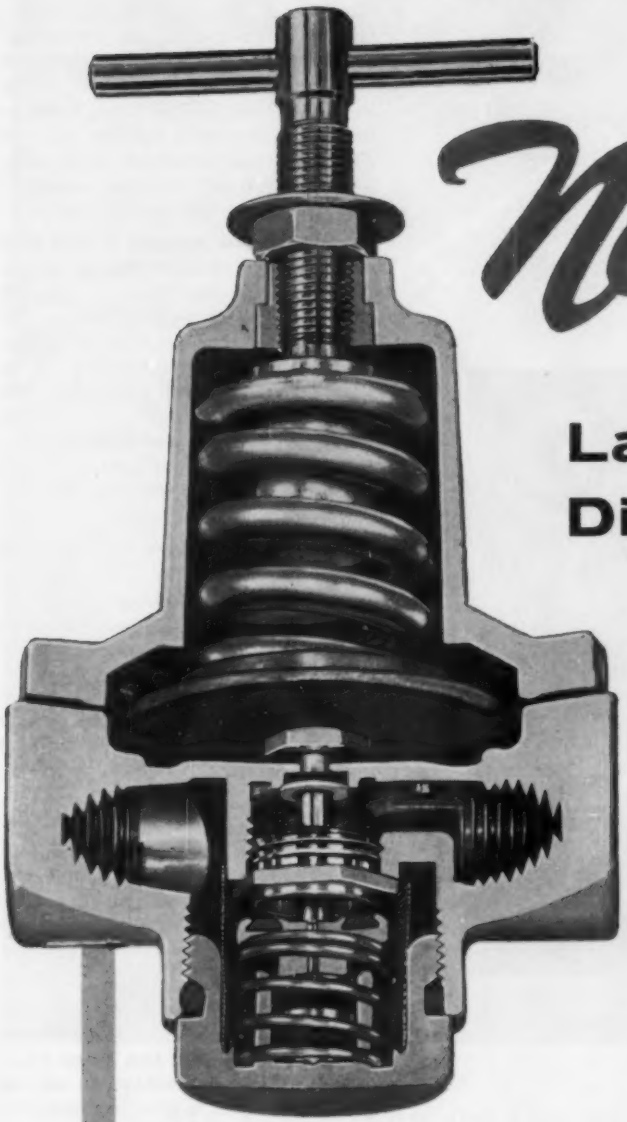
E. HILFICKER
C. H. Wheeler Mfg. Co.
Philadelphia 32, Pa.

We are leaning more and more towards hydraulic actuating equipment in our new table designs, taking advantage of the many improvements in seals, hose and fittings now available. Our equipment is used in hospital operating rooms and we, therefore, are not permitted any oil leakage.

We recently designed a piece of equipment incorporating O-ring seal fittings throughout, only to discover upon ordering, that a number of the fittings we needed even though they were shown as catalog items were not standard stock parts. This, of course, made them prohibitive and necessitated our returning to the pipe thread design. This I feel was a step backwards.

CARL H. BOETCKER
American Sterilizer Co.
Erie, Pa.

All Pressure Regulators are not alike



Norgren

Large effective Diaphragm area

provides closer pressure regulation

The extra-large effective diaphragm area in Norgren Pressure Regulators provides maximum sensitivity to fluctuating operating conditions.

Any slight deviation in regulated pressure, either as a result of fluctuating line pressure or varying flow demand, results in a greater total change in the force exerted by the diaphragm against the regulating spring. The valve immediately provides compensating action. This makes possible a highly uniform regulated pressure.

Regulator performance is better because a more stable regulated pressure is maintained over a wide range of operating circumstances.

The Norgren diaphragm is made of nylon-reinforced Buna N synthetic rubber, a combination that provides extra-long service, resulting in longer regulator life, more dependable operation and minimum maintenance.

Norgren Pressure Regulators give you these important features:

- Balanced Valve Construction—improved regulator performance
- Large Nylon-reinforced Buna N Synthetic Rubber Diaphragm—long service life
- Baffle and Siphon Tube—increased accuracy
- Large Passages and Valve Openings—large flow capacity
- Easy servicing while still on air line
- Flexible Valve Pin—assures better seating

For complete information on all your regulator needs, ⅛" to 2", call your nearby Norgren Representative listed in your telephone directory—or WRITE FACTORY FOR DESCRIPTIVE LITERATURE.

C. A. NORGREN CO. FOUNDED IN 1926

3402 SOUTH ELATI STREET • ENGLEWOOD, COLORADO

PLASTICS in Design Engineering

New Teflon* FEP resin enables Garlock to supply mechanical and electrical parts of complexities never before achieved.

New developments in TEFLON FEP shapes and parts by Garlock. With the commercial availability of Teflon FEP, Garlock can now fabricate mechanical and electrical components never before possible with Teflon TFE. The reason is this—whereas TFE must be processed like powdered metals, the new FEP has the advantage of being melt-processed in conventional extrusion and injection molding equipment.

Think of what this means to you as a designer. You can now specify Teflon for the most delicate and complex shapes you may design. Teflon FEP opens whole new avenues of design possibilities . . . parts of the most intricate shapes . . . wall sections of minimum thinness of .020″-.030″ . . . pieces with the closest of tolerances. Garlock also furnishes Teflon FEP in rod stock for ready cutting and machining.

Another important point. Developed as a supplement to Teflon TFE, the new FEP resin exhibits the same fine physical properties of chemical inertness, top thermal stability, excellent dielectric strength, and outstanding anti-stick and frictional characteristics. FEP is rated at a continuous service ceiling of +400°F, will resist extreme cold down to −395°F.

At low temperature, FEP has more impact resistance than any other known plastic. It is virtually unaffected by weather and remains unchanged when subjected to ultra-violet light and ozone attack. Finally, water absorption of FEP is zero!

Turn to Garlock—and their years of experience in fabrication of plastics—for more information on stock shapes and intricate parts of new Teflon FEP. The Garlock representative serving you will be glad to give you complete details. Call him at the nearest of Garlock's 26 sales offices throughout the U.S. and Canada. Or, write for catalog, Garlock Inc., Palmyra, New York.

GARLOCK

Canadian Div.: Garlock of Canada Ltd.

Plastics Div.: United States Gasket Company

Order from the Garlock 2,000 . . . two thousand different styles of Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastic Products

*Du Pont Trademark for TFE and FEP resins

He's mopping up the mess for the last time

At a leading aircraft research center, high-frequency vibration caused severe oil leakage from hydraulic lines servicing a huge wind tunnel. Many man-hours each month were wasted cleaning up the basement floor underneath, even though drip pans were used extensively.

Now, after a change to a Suntac oil, the vibration-caused leakage has been reduced to a point where "mop-up" is not needed. Hydraulic-fluid consumption has been cut by 4000 gallons a year. That's economy! That's Sun quality—the best economy of all.

If your plant is troubled with a leaky system, a Suntac antileak hydraulic oil can save you money, too. Ask your Sun representative to show you the Suntac desk-top demonstration, or write direct to SUN OIL COMPANY, *Philadelphia 3, Pa., Dept. AH-7. In Canada: Sun Oil Company Limited, Toronto and Montreal.*

SUNOCO

MAKERS OF FAMOUS CUSTOM-BLENDED BLUE SUNOCO GASOLINES

BRIEFS

about fluid power

Cylinders Get Truck Over Bumps

Hydraulic cylinders bend the Flex-Trac rough-terrain truck in the middle. The main control valve can raise the front or rear wheels, raise the center wheels, or let all six wheels stay on the ground. The truck can be articulated and held at a 30-deg. angle.

The two models are Swiss designed. Clark Equipment Co. is evaluating them for commercial use.

Gear pumps supply 2000 psi to the two double-acting cylinders which articulate the truck. The spring-loaded main valve returns to center when the operating lever is released. This closes the cylinder ports, and the truck's "posture" stays as it is. With the valve in "float" position, cylinders and pump are open to tank, and all wheels accommodate themselves to the terrain.

The center wheels are mounted on an axle with a conventional differential at the center. On each side, a pair of arms pivot about the center. These four arms are roller chain housings. At their ends are the front and rear wheels. All three wheels on each side rotate together.

• **Body Articulation**—The truck body can be articulated somewhat independently of the frame. Double-acting cylinders support the front of the body. The two rear body-support cylinders are single-acting. The rear body is heavy enough to retract them. Three 2-position valves, working with the main valve, control the body-support cylinders. Only one pair can be operated at a time. Oil is free to flow between the front cylinders, and between the rear cylinders. This allows the wheels to adjust to the terrain.

The larger truck's body can be kept horizontal (within limits) while traversing a lateral slope. It has two main control valves. One side can be articulated while the other floats. Accumulators cushion all cylinders except the frame cylinders of the smaller model. ▼▼▼

Government Makes Fluid Power Study

The Fluid Power Advisory Committee of the Business and Defense Services Administration, U. S. Department of Commerce, surveyed the industry in 1957. They wanted to get data for defense mobilization purposes, and to provide the industry with production and marketing data.

Questionnaire form BDSA F-503 was sent to every known possible manufacturer of fluid power systems. After reviewing the completed forms, the committee said that the number of producers was 288.

Among results for 1957 were:

Shipments, All Fluid Power Products, End-Use	millions
Industrial	$217
Airborne	192
Marine & Ordnance	17
Mobile	98
Total	524

Valve Shipments, End-Use	
Industrial	$100
Airborne	81
Marine, Ordnance & Mobile	32
Total	213

Pump Shipments, End-Use	
Industrial	37
Airborne	72
Marine & Ordnance	8
Mobile, Except Passenger Cars	27
Total	144

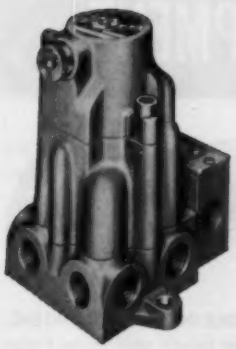
NCIH Papers Scheduled

CHICAGO—Director John Pippenger and the NCIH Executive Committee have drafted a tentative program for the 16th annual

Continued on page 26

Circle 68 →

Compare what the **PDQ WILL DO...**
Compare the **PDQ PRICE...**
With any other air valve...



a ½" valve that will do a ¾" valve job at a ⅜" valve price

- ☑ Accessibility
- ☑ Simplicity
- ☑ Speed and Capacity
- ☑ Price and Quality

What will the PDQ do? It will do a ¾" valve job. It has faster response time and greater capacity than valves twice its size and four times its weight. To repack you simply replace 2 self-contained units in less than a minute. You can change valves on the line in less than 30 seconds.

Will the PDQ last? The PDQ has a short stroke, and a light but rugged aluminum construction with built-in wear compensation. Anticipated valve life is conservatively estimated at 35 million cycles . . . on most applications this is **years** of trouble-free service. Coil (properly applied) is unconditionally guaranteed for the life of the valve.

How about the price? The PDQ is a ½" valve at a ⅜" valve price. Write us today.

A. V. Ney

A. V. Ney, Sales Manager

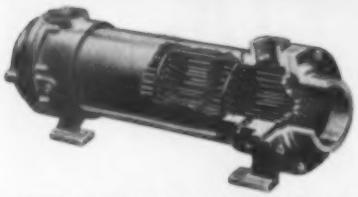
HUNT VALVE COMPANY · SALEM, OHIO, U. S. A.

HUNT V C ***Quick-As-Wink*** AIR & HYDRAULIC CONTROL VALVES

Yates-American

FOR TOP QUALITY

HEAT TRANSFER EQUIPMENT . . . with a size and type for every purpose

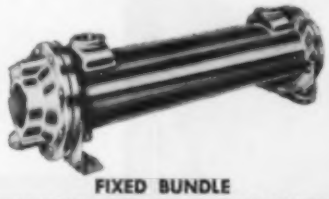


FIXED BUNDLE HEAT EXCHANGERS
For broadest heat transfer applications. Flanged baffles . . . rolled tube joints . . . single and multiple pass designs. Popular sizes from 2" to 8" diameters available from stock.

Today's broad line of Y-A liquid heating and cooling units is the result of over 25 years of engineering experience and manufacturing skills serving the diversified needs of industry and the military services.

With engineering consultation and modern research and testing facilities, it is Y-A's continuing endeavor to assist you in attaining the most practical, efficient and economical equipment applications for your heat transfer requirements.

REMOVABLE BUNDLE HEAT EXCHANGERS
Lantern type floating head . . . straight ⅜", ½" and ¾" O.D. bare tubes or ⅝" finned tubes . . . diameters up to 31" . . . materials available to meet specific requirements.



FIXED BUNDLE STAINLESS STEEL HEAT EXCHANGERS
For corrosive types of hydraulic oils or other liquids. Rolled tube joints . . . wider, heavier gaskets . . . ¼" and ⅜" tube sizes . . . unit sizes from 2" to 10" diameter.

ENGINE COOLING RADIATORS
For all types of water cooled engines. Die-drawn, cast, or fabricated construction . . . complete range of efficient cores . . . panel or sectional construction.

PIPELINE AFTERCOOLER
For air and gas compressors. High efficiency . . . minimum water consumption . . . no vibration wear. Moisture and oil mist centrifugally separated. Selective end arrangements.

FOR: DIESEL ENGINES • TORQUE CONVERTERS • MACHINE TOOLS HYDRAULIC PRESSES • PROCESSING PLANTS

Over 75 years of service to industry

HEAT TRANSFER DIVISION

Yates-American

705 4th St., BELOIT, WISCONSIN

Circle **145** on Time-Saver Card

BRIEFS

meeting, October 20-21. Papers will give the field of hydraulics a thorough treatment. Subjects cover applications from mining to missiles.

Papers at the opening session will cover Hydraulics in British Mines and Hydraulic Filtration.

Four simultaneous sessions are planned for the afternoon. Topics will be Materials Forming Machinery, Mobile Equipment, Servo Mechanisms and Systems, and

LIGHT REFLECTED FROM A POLISHED METAL TABLE brings out the smooth interior of a hydraulic cylinder barrel. For their cold-worked tubing, Republic Steel engineers have developed a technique which measures smoothness to millionths of inches. After a visual spot check, they measure surface finish at least an inch from the end of the tube length. They take readings at four places, 90 deg apart. Traces are at least 0.60" long. Three of these measurements are made along the tube's axis. The mean of indicator readings during a trace is averaged with those taken at other spots on the tube, to find the tube's micro-inch reading.

Missiles and Space Hydraulics. The next morning, speakers will consider Aircraft Systems, Automotive Hydraulics, and Hydraulic Fluids. Final papers are scheduled on Components and Accessories, Machine Tools, Pneumatics, and Pumps.

To register, contact NCIH Secretary LeRoy A. Wickstrom, Illinois Institute of Technology, Chicago 16.

Continued on page 28

add this new twist to your profit picture

NO FLARING
NO THREADING
NO SOLDERING
NO WELDING

assembled anywhere--
with just a wrench
and lubricant

WEATHERHEAD ERMETO STEEL FITTINGS

ERMETO Ease of Assembly Saved These Companies TIME and MONEY

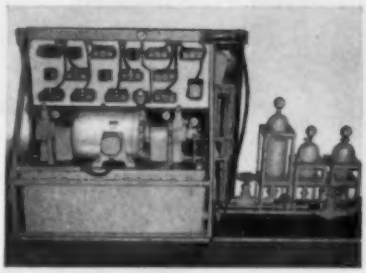
Weatherhead Ermeto flareless hydraulic fittings—easily assembled by inexperienced personnel without elaborate tools—are enabling many companies to achieve important installation savings in both time and money. In service, the excellent leak-proof, anti-vibration characteristics of Ermeto fittings keep maintenance and down-time at a minimum. Ermeto fittings are available in stainless or carbon steel with "Weathercote" or cadmium finish. All shapes in sizes: ⅛ to 2", for pressures up to 10,000 psi.

SAVED: $5,000

COMPANY: Good Roads Machinery Corporation Minerva, Ohio.

APPLICATION: Carbon Steel Ermeto fittings on hydraulically-actuated snow plows on industrial tractors. Operated with hydraulic oil at 100° F and 400 psi.

RESULTS: Ermeto fittings saved the company $5,000 because of their ease of assembly and because experienced help was not necessary.

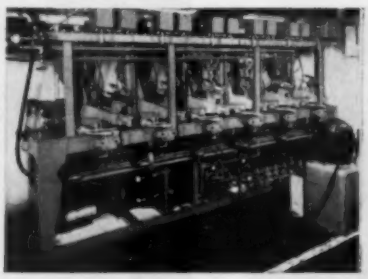


SAVED: 60 HOURS

COMPANY: Portland Industries South Portland, Maine

APPLICATION: Carbon Steel Ermeto fittings on automatic transfer machine for making carburetor bodies. Operated with hydraulic oil at 120° F and 800 psi.

RESULTS: Utilization of Ermeto fittings saved the company 60 hours in installation time — thanks to the ease and simplicity of assembly.



SAVED: 40 HOURS or $240

COMPANY: Emhart Manufacturing Company Hartford, Conn.

APPLICATION: Carbon Steel Ermeto fittings on pressure forming machine for small parts manufacture. Operated with hydraulic oil at 130° F and 1500 psi.

RESULTS: Ermeto fittings provided an estimated savings of 40 hours or $240 in installation time. Ermeto fittings were used specifically because of their ease of assembly.

WEATHERHEAD
BULK HOSE AND HOSE ASSEMBLIES

BULK HOSE
Twenty different styles available. From ¼" to 2" O.D. for working pressures up to 10,000 psi.

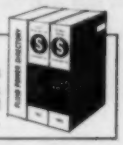
HOSE ASSEMBLIES
Completely fabricated with permanently attached swaged ends. Any size, any quantity for working pressures up to 10,000 psi.

Write for new general catalog — contains complete data and specifications for all items.

BRASS & STEEL FITTINGS
HOSE & ASSEMBLIES
TOOLS & ACCESSORIES

WEATHERHEAD

FOR DETAILS
See Weatherhead catalog in Sweet's Product Design File, Plant Engineering File, the Fluid Power Directory, or write direct.



THE WEATHERHEAD CO., FORT WAYNE DIVISION • Dept. AH-7
128 West Washington Blvd. • Fort Wayne, Indiana
In Canada: The Weatherhead Co., Ltd., St. Thomas, Ont.

BRIEFS

Fluid Power At The Design

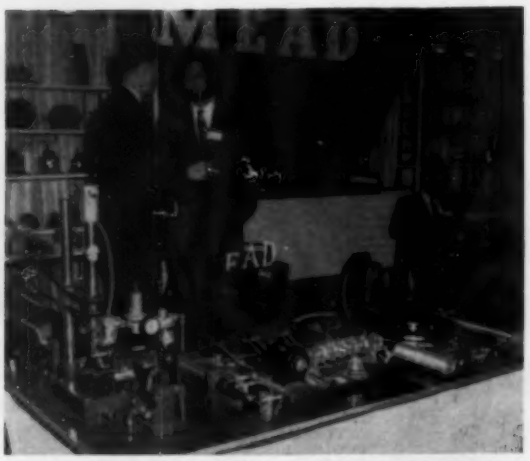
Camera in hand, H & P editors roamed through four floors of industrial wares at the recent Design Engineering Show in New York. Here are some of the interesting working displays that fluid power manufacturers used to explain their products.

TORSIONAL AND FLEXURAL STRENGTH of reinforced plastic hose showed up on this test rig of Samuel Moore & Co. A polyester braiding makes the hose equivalent to single wire braid rubber hose and eliminates metal abrasion.

AN AIR MOTOR arranged with a rack and pinion mechanism to reciprocate two spray guns was featured at the Gast Manufacturing Corp. display.

TRANSPARENT CIRCUIT was featured at Wooster Div., Borg-Warner Corp. Pump, motor, cylinder, valves and lines were all lucite to show component operation and oil flow.

ASSEMBLY AND HYDROSTATIC TEST of a needle valve was performed on this equipment of Hoke, Inc. The actual production fixture leak tests the valves at 2000 psi.



COMPLEX SEQUENCING of an air circuit was demonstrated by Mead Specialties Co. who spelled out their name with air actuated letters.

Engineering Show

LOOK CLOSELY and you could see the fog lubrication in this air line control display at C. A. Norgren Co. Miniature filter, regulator, and lubricator are installed in the air line ahead of the clear cylindrical chamber. Fog lubrication shows up in chamber when air is used.

HIGHLIGHT AT VICKERS, INC. was this servo demonstration stand to show uses of the company's building block servo components. Fluid motor speed and cylinder position were set manually or with programming controls.

TO PROVE EFFECTIVENESS of its double bladed, rod wiper, E. F. Houghton & Co. set up this cylinder with its rod working in a pan of dirt.

LUCITE CYLINDERS at the Crane Packing Co. exhibit showed U-cup and O-ring action in a double acting cylinder.

CYLINDERS DON'T HAVE TO LEAK. This theme was expressed at the Parker-Hannifin Corp. display where two cylinders were reciprocated continuously with the aid of a piston accumulator.

DIAL

The standard pump-motor combination you need!

Eastern CENTRIFUGAL PUMPS...

Pick the pump and performance matched to your requirements:

- **PRESSURES:** to 21 psi in single stage pumps; to 70 psi in multi-stage types
- **FLOWS:** capacities to 70 gpm in single-stage pumps, to 10 gpm for many multi-stage models
- **MOTORS:** standard motors for 115/230-volts 60 cycles 1 phase (other electrical characteristics available). Power range from ⅛ to 1½ H.P.
- **ENCLOSURES:** drip-proof, totally enclosed, and explosion-proof ball-bearing frames
- **DRIVES:** all models available in belt or coupling drive with ball-bearing-equipped stands. Space-saving close-coupled pumps most rugged and popular—but many pedestal models also available
- **SEALS:** a variety of rotary seals and stuffing boxes, to fit every application
- **METALS:** your option of cast iron, bronze, stainless steel, Monel, Cast Iron, Hastelloy "C"
- **INSTALLATIONS:** a wide range of transfer, recirculation, feed, boost, and filter-pumping applications

one or more is just right for you!

TO FIND OUT: write for the brand-new Centrifugal Pump Catalog — Bulletin 130. Here are **all** the models — and a wealth of basic engineering data besides. For a complete review of Eastern **positive displacement pumps,** write for Bulletin 220. And Eastern Bulletin 810 is your guide to a broad line of high-speed **gear pumps** and **hydraulic motors.**

EASTERN INDUSTRIES, INCORPORATED

EASTERN INDUSTRIES • PUMP DIVISION •

100 Skiff Street Hamden, Conn.

WEST COAST OFFICE
4203 Spencer St., Torrance, Calif.

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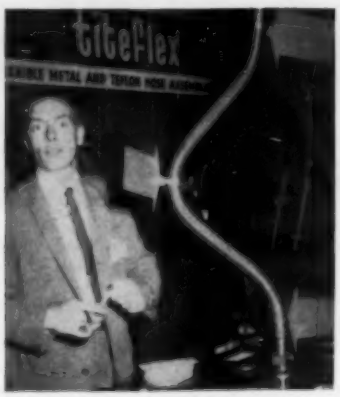
BRIEFS

Design Engineering Show

CYLINDER SPEEDS WERE COMPARED on this demonstration stand of Skinner Electric Valve Div. It shows valves controlling cylinders of various sizes to indicate relative speeds.

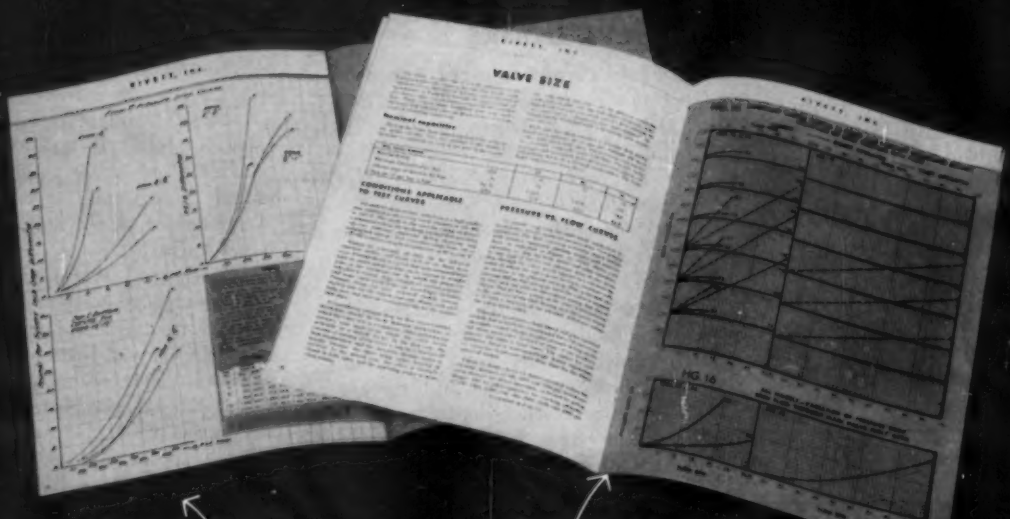


FLEXIBILITY OF TEFLON HOSE reinforced with a metal braid was emphasized at the Titeflex, Inc. booth where this display showed how compliant the hose is.

PNEUMATICALLY ACTUATED, abrasive cut-off machine was shown by A Schrader's Sons, Div. who supplied components for the machine. It cuts a dual mitre.

More Briefs on page 32

STOP GUESSING VALVE PERFORMANCE!



CAT. NO. 210 Shows correct choice of Manually Controlled 4-Way Hydraulic Valves

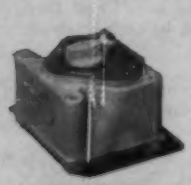
CAT. NO. 230 Shows correct choice of Pressure Controlled Hydraulic Valves

RIVETT Publishes The Facts So You Can Predict Accurately Pressure Drop In 4-Way and Pressure Controlled Hydraulic Valves!

Select your valves on facts, not guesses! The flow versus pressure drop curves shown in the catalogs above are based on actual tests. The curves make it possible to determine system efficiency and operating costs *before* you operate the circuit. Rivett's lower pressure drop means a lower cost to actually run your hydraulic systems. Before you specify the components for your next system, get the facts! Ask your Rivett dealer, or write for Rivett Catalogs 210, 230, 250 and 261 now.

RIVETT

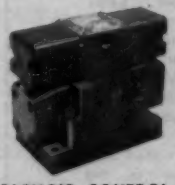
Furnishes Complete Line of Hydraulic Valves — Over 400 Standard Models — 1500, 2000, 3000 P.S.I.—Sub-Plate and Pipe Mounted—¼" to 1½" Sizes—3 G.P.M. to 130 G.P.M.



FLOW CONTROL
Model 8622: 3000 P.S.I., Sub-Plate Mounted. Four Sizes: ½" to 1½". See Catalog 250.

PRESSURE CONTROL
Series 8800: Relief, Sequence, Unloading, Reducing, and Counterbalance. With and without check. See Catalog 230.

MANUAL CONTROL
Series 5000 and 6100: 4-Way. Hand, Foot, or Cam. Sub-plate or Pipe Mounted. ¼" to 2" sizes. 2000 and 3000 P.S.I. See Catalog 210.



SOLENOID CONTROL
Series 6500 and 6600: 4-Way. Direct or Pilot operated. ⅛" to 1½" in three basic sizes. 3000 P.S.I. Low current. See Catalog 261.

PILOT CONTROL
Available in Solenoid, Pressure and Manual operations. ⅛" to 1½" sizes. 1500, 2000 and 3000 P.S.I.

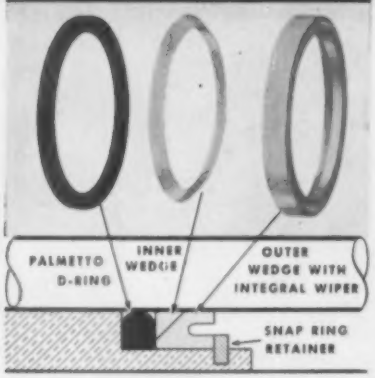
RIVETT

RIVETT, Dept. AH-7, Brighton 35, Boston, Mass.
furnishes a complete power package
AIR AND HYDRAULIC — VALVES, CYLINDERS, POWER UNITS
Member — National Fluid Power Association

Designing With the D SEAL W

PATENTS ISSUED AND APPLIED FOR

—the newest advance in packing technology from PALMETTO® Engineering



• The new Palmetto D-W Seal provides a compact, low-cost seal which matches the performance of costlier, bulkier packings. Designed primarily to provide a superior seal on rods subject to reciprocating motion in hydraulic or pneumatic service.

The unique D-W Seal offers these outstanding advantages: SHARPLY REDUCED MACHINING COSTS • LESS COST FOR PACKING • SAVING OF SPACE • POSITIVE SEAL WITHOUT EXTRUSION • INTEGRAL ROD WIPER

HOW THE PALMETTO D-W SEALS

Palmetto D-ring, installed under slight compression, rests firmly on its square base . . . provides a positive seal under low or high pressure. Double wedge back-up rings contribute bulk and stability . . . guard the D-ring from rolling, twisting, or extruding. Self-centering action of seal assembly also adds bearing support . . . helps center the rod while under pressure. Lip on second wedge exerts dependable wiping action . . . avoids need for separate wiper element. Entire D-W seal assembly fits into counter-bore in cylinder head . . . is secured with a snap ring near cylinder head's outside surface.

Since the D-ring element is furnished in a broad range of rubber compounds, the D-W Seal operates with any fluid and at temperatures from minus 70F to 600F. The standard back-up wedge rings are made of nylon, but other plastics or metals can be supplied to meet specialized application conditions to give the D-W Seal complete versatility.

• *For more particulars, write:*

GREENE, TWEED & CO.

NORTH WALES, PA.

Circle **58** on Time-Saver Card

BRIEFS

New Books

Fluid Power Control, *edited by John F. Blackburn, Gerard Reethoff, and J. Lowen Shearer,* 710 *pp,* $17.50, *published jointly by The Technology Press of MIT and John Wiley & Sons, Inc.*

The book succeeds sets of notes for summer refresher courses at MIT for engineers from industry. It is based on the experience of the fluid-power group of the Dynamic Analysis and Control Laboratory, and of the MIT mechanical engineering department.

The first section summarizes the properties of commercial fluids, and comments on choice of media. It reviews the fluid mechanics most interesting to the engineer. It covers the generation and use of fluid power, and suggests further work in fluid transmissions.

The second section is about valves. Subjects are choice of valves, control valves, spool-valve design and manufacture, steady-state forces on valves' moving members, torque motors, and valve instability. Included is a detailed account of the design of a miniature hydraulic servo which was intended as an actuator for larger valves.

A review of system dynamics begins the third section. Its seven chapters treat hydraulic and pneumatic drives, and hydraulic transmissions. They show that good servo performance is obtainable with a gas. Final chapters analyze closed-loop fluid-power systems, and compare hydraulics with pneumatics. ▼▼▼

More Briefs on page 36

BRIEF NOTES

DEFENSE PRODUCTS GROUP ESTABLISHED . . . within Racine Hydraulics & Machinery, Inc. The new department will develop a long-term program of government work to supplement the firm's regular production.

NEW FAMILY OF ELASTOMERS . . . has been developed by Goodyear Tire & Rubber Co.'s chemical division. Chemi-Vic has the advantages of nitrile rubber, plus good ozone and abrasion-resistance. These properties suit it for hose covering and other mechanical goods.

R&D MANAGEMENT DEVELOPMENT SEMINAR . . . for middle management representatives will be conducted by Pennsylvania State University, July 24-29. Workshop and lecture session will cover development of administrative skills, the role of management, leadership, motivation, communication, training, and rating.

BUSINESS BRIEFS

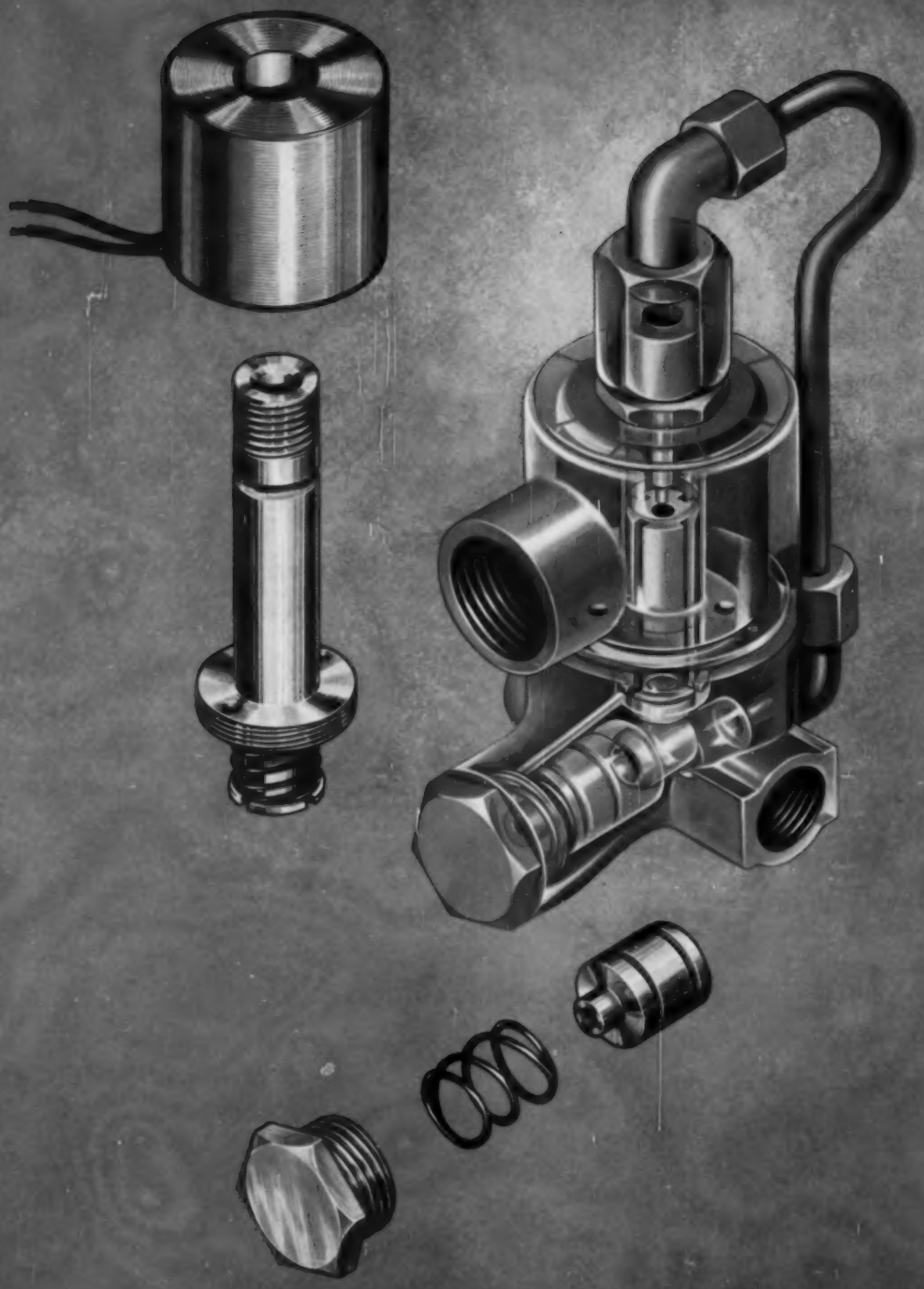
$35,875.54 IN PROFIT-SHARING CHECKS . . . were recently given to 75 production and clerical employees of Snap-Tite, Inc., Union City, Pa. Payments amounted to $.258 per hour worked by each employee last year. The plan is in its fifth year.

MOORE NEEDS MORE ROOM . . . By late summer, Samuel Moore & Co., Mantua, Ohio, will have completed a 70% plant expansion—its sixth since 1947. Moore's Synflex Products Div. makes and sells hydraulic hose.

WABCO CONSOLIDATED SALES, PROFITS UP . . . For the first quarter of 1960, consolidated sales of Westinghouse Air Brake Co. and its subsidiaries were $46,757,163. This is up 11% from last year's $41,988,902 first quarter. Net income increased from $1,985,814 to $2,008,417.

MILLER CHANGES PRICES OF CYLINDERS & BOOSTERS . . . Lower base prices on small to medium-bore hydraulic cylinders are among the price changes shown in a new booklet of Miller Fluid Power Div., Flick-Reedy Corp. The 12-page pricing booklet details prices of cylinders, boosters, accessories, and optional components.

Circle **119** ➞

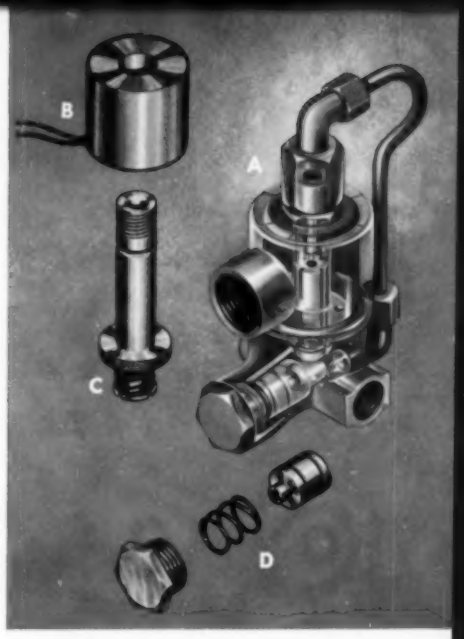


SKINNER 2-way Solenoid Valves

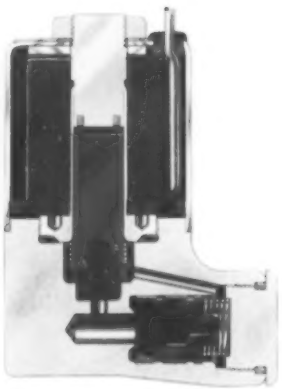
for high flow, high pressure applications

Here's how Skinner two-way valve design provides long lasting, trouble-free operation

- **Underwriters' Laboratories approved**
- **Stainless steel internal parts resist corrosion**
- **Forged naval brass body**
- **Famous Skinner V5 solenoid operator**
- **Well rounded main orifice and pilot seats**



A—Transparent view of normally open 2-way R type valve with piped pilot exhaust return
B—Coil C—Sleeve, plunger and spring assembly
D—Piston assembly with soft synthetic insert



NORMALLY CLOSED TYPE R2

When you have high-flow control problems at standard or high pressures the new Skinner two-way R series valves may be the answer. These pilot-operated solenoid valves are designed for use with air, oil, water, inert gases and other common media at operating pressure differentials of 5 up to 1250 PSI. They may be used for all types of control applications, such as: in high-pressure lifting, commercial laundry equipment, machinery, machine tooling, spraying, etc.

Skinner R series two-way valves have forged naval brass bodies to provide a dense metal structure and use a foolproof stainless steel piston with soft synthetic insert to open and seal the main orifice. Types are available normally open or normally closed, in standard and explosion-proof construction.

To make installation easy for every application, a wide choice of electrical housing options is available. These include JIC, AN connector, automotive terminals, etc. All housings can be rotated 360°. Manual override is also offered to permit manual opening of normally closed valves, or closing of normally open valves, in emergency.

Skinner R series valves may be used with all common voltages and frequencies and there are several coil types such as: varnished, molded waterproof, tropicalized and high temperature for specific applications.

The R series, illustrated here, is just one in a complete range of 2-, 3- and 4-way Skinner solenoid valves.

TWO-WAY R SERIES SPECIFICATIONS

Types	R2 XR2	R2H XR2H	R2H6	RP1 XRP1
Position	Normally closed	Normally closed	Normally closed	Normally open
Pipe Size (NPTF Dry Seal)	¼"	¼"	¼"	¼"
Orifice Size	¼"	¼"	¼"	¼"
Cv Factor	.758	.758	.758	.758
Operating Pressure Differential (PSI) Minimum	5	5	5	5
Maximum AC Service	200	1250	—	150
Maximum DC Service	200	500	1000	150
Leakage	Bubbletight	Bubbletight	Bubbletight	Bubbletight
Temperature Range (Ambient and Media)	Minus 40°F to plus 180°F	Minus 40°F to plus 180°F	Minus 40°F to plus 180°F	Minus 40°F to plus 180°F

When you specify solenoid valves, specify Skinner. Skinner solenoid valves are distributed nationally.

For complete information, contact a Skinner Distributor listed in the Yellow Pages or write us at the address below.

SKINNER ELECTRIC VALVES

THE CREST OF QUALITY

SKINNER ELECTRIC VALVE DIVISION,
THE SKINNER CHUCK COMPANY • NEW BRITAIN, CONNECTICUT, U.S.A.

PRINTED IN U.S.A.

Reusable and Swaged-On Assemblies!

COMPLETE LINE OF SURGEPRUF COUPLINGS AND HYDRAULIC HOSE

Now from one reliable source... a full range of Swaged-on Assemblies and Shurlock Reusable Couplings, Hydraulic Hose... and Adapters!

Get superior performance . . . dependable operation with the expanded Surgepruf line. From low pressure to high pressure hydraulic applications, Surgepruf new design and quality features provide the rugged and dependable service you *need* for *all* equipment . . . plus fast, easy on-the-job replacements!

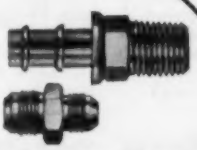
Contact your Wholesale Supplier—or write for the following Surgepruf catalogs: No. 40-25, Reusable Coupling and Hose Catalog; No. 40-37, Swaged-on Hose Assemblies Catalog; No. 40-36, Adapters Catalog. Dept. 524, 1850 Diversey Parkway, Chicago 14, Illinois.

Only Surgepruf Reusable Couplings and Hose Have These Outstanding Features:

Superior Fluid Seal eliminates seepage between coupling shell and wire braid • Non-Skive Assembly provides fastest field assembly with just ordinary tools • Superior Finish—precision-machined steel couplings have zinc dichromate finish to pass rigid salt-spray tests • Full Interchangeability—regardless of hose line, Surgepruf couplings are available in any style and thread.

Symbol of SW Excellence

ALEMITE DIVISION
STEWART-WARNER CORPORATION
1850 Diversey Parkway, Chicago 14, Illinois



Reusable Couplings & Adapters Available in a complete range of thread styles and sizes for all types of machine connections.

High Pressure Hose. Burst and working pressure equivalent to SAE 100R2. In hose ID's from ¼" to 2".

Medium High Pressure Hose. Burst and working pressure equivalent to SAE 100R1. In hose ID's from 3/16" to 1 13/16".

Medium Pressure Hose. Complies with SAE 100R3 requirements. In hose ID's from ¼" to 1".

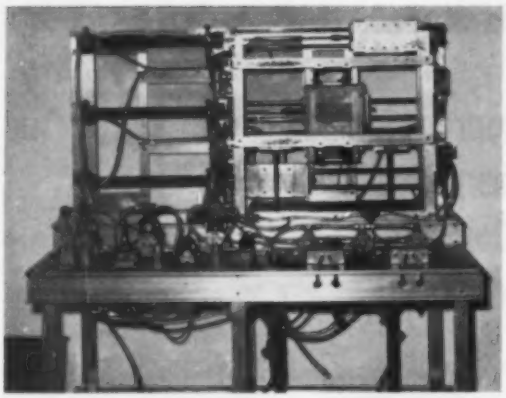
Low Pressure Hose. Burst pressure, 1000 psi.; working pressure, 250 psi. In hose ID's from ¼" to 3/8".

PRINTED IN U.S.A.

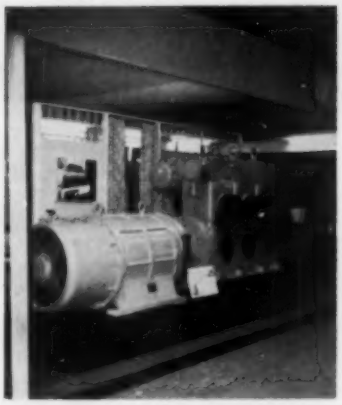
BRIEFS

Displays at British Fluid Power Show

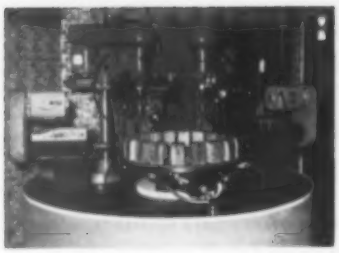
The 1st International Compressed Air and Hydraulics Exhibition, held this spring in London, featured . . .



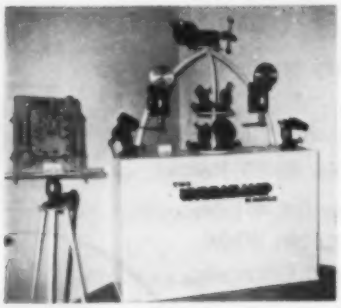
. . . a working display of air sequencing for automatic handling of boxes, packages, or crates. The Ross Components are made under license in the United Kingdom by The Wellman Smith Owen Engineering Corp.



. . . a 2-stage, water-cooled compressor from Prague, Czechoslovakia. Its three cylinders deliver 1000 cfm at 114 psi.

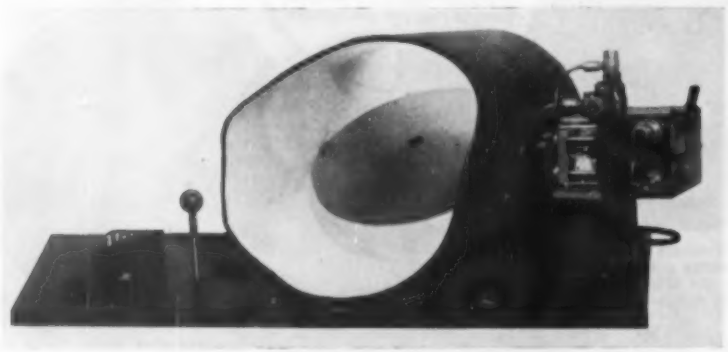


. . . a rotary drilling outfit which combines electrical sequencing and pneumatic indexing motions. After the air drills withdraw, the fixture rotates, to present another set of workpieces. Manufacturer is British Bellows Div., George H. Hughes Co., Ltd.



. . . workholding and positioning Hydraclamps for assembly, fitting, welding, and general production. Spencer Franklin Ltd., London, showed them.

. . . radial air compressors by Bauer Kompressoren, Munich, Germany. The stationary and portable compressors are for pressures to 100 psig.



. . . a servomotor which controls a large butterfly valve. An integral hydraulic flow control limits the valve's maximum permissable rate of operation, regardless of output loading. It was displayed by Short Brothers & Harland, Ltd., Belfast, Northern Ireland.

. . . a hydraulic rock drill drive, made by the recently-formed Denison-Deri Ltd. A hydraulic pump feeds two fluid motors geared to the vertical drill shank. The control desk varies drill rotation.

More Briefs on page 38

Illustrated—New 9700 Series
Piggy Back Hydraulic Control Valve
Meets J.I.C. Standards

Look to Logan

the ultimate in hydraulic valve design

FREE SEND FOR THE "LOGAN CALCULATOR"
A gift to you from Logansport Machine Company upon request.

MEMBER: Natl. Mach. Tool Builders Assn.; Natl. Fluid Power Assn.

LOGANSPORT MACHINE CO., INC.
832 CENTER AVENUE, LOGANSPORT, INDIANA

PLEASE SEND COPY OF CATALOG:

- ☐ 100-1 AIR CYLINDERS
- ☐ 100-2 MILL-TYPE AIR CYLS.
- ☐ 100-3 AIR-DRAULIC CYLS.
- ☐ 100-4 AIR VALVES
- ☐ 100-5 LOGANSQUARE CYLINDERS
- ☐ 100-5-1 ULTRAMATION CYLINDERS
- ☐ 51 PRESSES
- ☐ FACTS OF LIFE
- ☐ 62 SURE-FLOW PUMPS
- ☐ 200-1 HYD. POWER UNITS
- ☐ 200-2 ROTOCAST HYD. CYLINDERS
- ☐ 200-3 750 SERIES HYD. CYLINDERS
- ☐ 200-4 and 200-7 HYD. VALVES
- ☐ 200-6 SUPER-MATIC CYLS.
- ☐ 70-1 CHUCKS
- ☐ ABC BOOKLET
- ☐ CIRCUIT RIDER

TO:

NAME_____ TITLE_____

COMPANY _____

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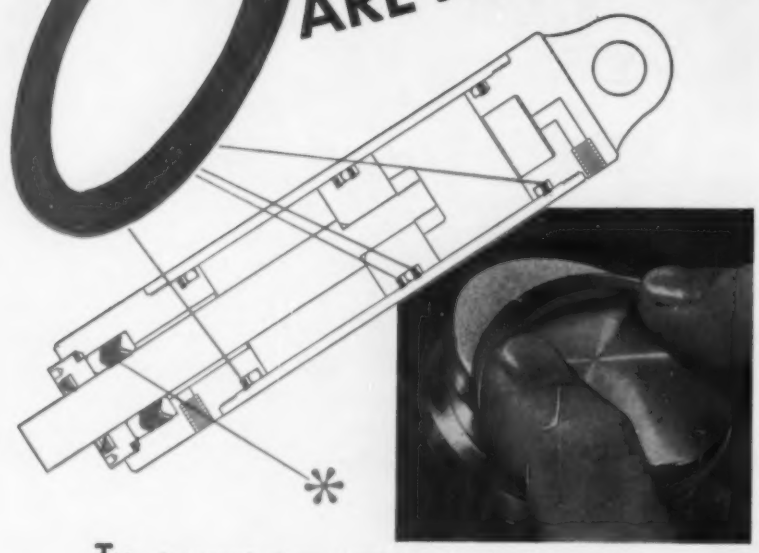
ALL BACK-UP WASHERS ARE NOT ALIKE



This photograph shows Marsh No. 612 back-up washers being slipped into position. The washers s-t-r-e-t-c-h manually, or with production tooling, over pistons and SNAP BACK to original size. Allows quick installation of piston into cylinder without danger of pinching.

MARSH No. 612 *Thermo* Leather non-extrusion washers have many superior features . . . used in supporting O-rings and V blocks in cylinders and tube fittings.

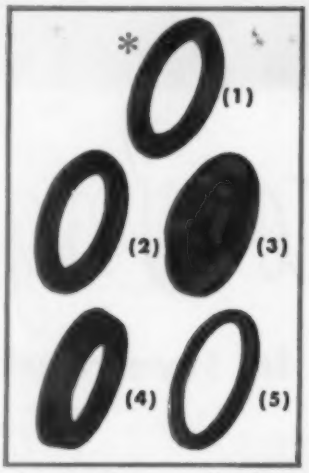
Rubberlike stretch with unaided dimensional recovery into groove.

Synthetic rubber impregnant impervious to *ALL* hydraulic fluids.

Sealing: air—petroleum base oils—synthetic fluids (water soluble and insoluble) — transmission fluids—solvents.

Operating temperatures: —65° F. to 212° F. plus.

For toughness unmatched, giving maximum protection against nicking by dirt and grit . . . with low friction and a minimum cold flow . . . try the Marsh No. 612 back-up washers. Available to all commercial and military dash numbers with the more popular sizes in stock.



(1) VEE PACKING • (2) U PACKING • (3) FLANGE PACKING • (4) CUP PACKING • (5) NON-EXTRUSION or BACK-UP WASHERS

Marsh impregnated *Thermo* Leather packings are custom engineered to individual specifications . . . to fit special temperature ranges . . . to meet specific pressure requirements.

ENGINEERING AND CONSULTING SERVICE — Laboratory Test Reports available on sealing fire-resistant fluids. Write for your free copy today.

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BRIEFS

NFPA Elects Frank Flick President

POINT CLEAR, ALA.: Officers for the 1960-61 year of the National Fluid Power Association were elected at the recent spring meeting. President is Frank Flick; he heads Flick-Reedy Corp. First and second vice-presidents are W. C. Richards, Jr. of Bellows Company and Oliver G. Lear, Sarasota Precision Products Co.

How to provide a stronger public relations program, more members increased marketing information, and assistance in educational programs are the major projects of the association.

PNEUMATIC SEAT BASE reduces the fatigue of drivers of hard-riding vehicles. Drivers literally ride on air. The three supporting rods insure free action of the seat, even when weight distribution is off-center. The air chamber can be charged in two ways. A 3-way valve does the job on vehicles with an air supply. For all other vehicles, a handpump makes the unit self-contained. The driver can vary the charge with the roughness of terrain. Designer-manufacturer is Eldervoy Mfg. Co., Lynwood, Calif.

• **Patent Service**—During the year, NFPA started a Patent Abstract Service for its members. Each month all patents relating fluid power are taken from the government's weekly Patent Gazette. The service is being used by

Continued on page 40

Circle **81** →

Air operates this folding machine to provide the neatly folded, factory-fresh shirts found in popular shirt stores. In the background, left, is an air- and steam-operated pressing machine that furnishes smoothly pressed shirts in seconds.

Compact 25S2 distributes air through 2-inch air-mains and laterals to individual machines. Mr. Hopper, (at right), expects "many years of trouble-free service from the Model 25S2 compressor."

Van Heusen "cuts operator fatigue—

ups output per machine by 10% to 20%" with a

LE ROI 25-HP STATIONARY COMPRESSOR

Shirt-making is exacting work. It's so tiring that an operator's output can drop 40% in five hours. To reduce fatigue and to maintain efficiency, "we prefer air control for the more delicate operations of sewing and trimming machines, laundry, pressing and creasing work," reports Charles G. Hopper, assistant to the production manager of the Pottsville (Pa.) plant of Phillips-Van Heusen Corp.

At least some of the credit for reducing fatigue and increasing production is given to the 25 horsepower Le Roi compressor which provides air-power in their shirt factory.

The 105 cfm, 125 psi capacity of the Le Roi 25S2 air-cooled compressor more than meets current needs, and provides for the addition of more air-operated machines. Mr. Hopper states that the unit operates 10 hours a day, five and one-half days a week. To assure dependable air supply, valves of the 25S2 are inspected weekly, and oil is changed every 200 hours.

Why don't you check the benefits of pneumatic operation? Le Roi can meet your needs with Westinghouse unit-type and Le Roi stationary air compressors from ½ to 100 hp. See your Le Roi distributor for more information. Or write to Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin.

LE ROI STATIONARY COMPRESSORS

SC-09

PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

Keep YOUR HYDRAULIC SYSTEM Clean with HILCO HYDRAULIC OIL FILTERS

- No More Varnish and Sludge Deposits
- No More Flushing and Manual Cleaning
- No More Frequent Oil Changes
- No More Accumulation of Dirt

Filter life up to a year eliminates usual frequent draining, refilling of systems.

HILCO Hyflow Oil Filters trap dirt, acids, rust, sludge, gums, resins . . . all solid contaminants, and keeps your hydraulic system clean and in top running condition at all times. To you, this means longer oil life, reduced wear and abrasion . . . hence, less down time and lower maintenance costs giving you continuous equipment operation with increased production. Hydraulic unit sensitivity depends upon a clean system. HILCO Hyflow filters remove solids as soon as they enter the system and retain much of the moisture which enters the oil from the atmosphere and from condensation. Obtain the full capacity and economy of your equipment by keeping it in top running condition with HILCO. Hydraulic Oil Filters come in stationary or portable models. They can be hooked into hydraulic systems without interrupting equipment operation.

HILCO OIL RECLAIMER

For complete oil reclaiming. Removes solids, acids and volatile impurities; moisture, solvents, gasses, etc., from hydraulic fluids by heat-vacuum process.

• SEE FOR YOURSELF HOW HILCO keeps your Hydraulic System Clean . .

WRITE TODAY FOR THIS *Free* BOOKLET

Recommendations at no Obligation

THE HILLIARD *Corporation*

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BRIEFS

management, marketing and technical men in member companies.

Another major project supported by NFPA is the organization of the Fluid Power Society (see HYDRAULICS & PNEUMATICS April, 1960, page 28). Memebers in this society are men whose work in industry is with fluid power. This new society will be the technical organization for engineers, technicians, and operating men who want to participate in local chapters.

NFPA is assisting in organizing and providing the initial financial support to form this national society.

• **Public Relations**—George Carlson, Minnesota Rubber Co., reported at the spring meeting on the program being developed by NFPA's public relations board. He showed the format of a new brochure written to tell the story of NFPA. It will describe the purposes, activities and organization of NFPA.

The association's monthly newsletter is also due for a revamping. Carlson presented a new design to give members news about business, government and other associations.

• **Management Services**—Education, cooperation with government agencies, tax information, and management tools are the areas covered by this board at the spring meeting. Pauline Ledeen discussed: "Latest Developments in Use Taxes".

What can be done about proprietary rights under government contracts? David Fromson, NFPA's counsel discussed the problem and some of the things which manufacturers should do to protect their know-how when going after government business.

• **When Is a Seal a Packing?**—The terminology group has approved 275 definitions of fluid power terms. The plan is to come out with a published glossary every two years.

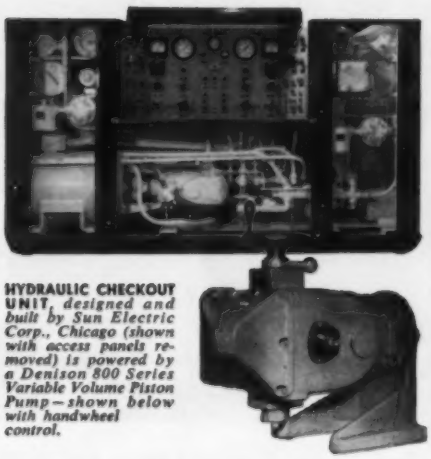
Continued on page 42

Denison and Denison HydrOILics are registered trademarks of Denison Eng. Div., ABSCO

DENISON HydrOILics

Flexible, high-accuracy simulation with DENISON hydraulic pump power for...

CHECKOUT



HYDRAULIC CHECKOUT UNIT, *designed and built by Sun Electric Corp., Chicago (shown with access panels removed) is powered by a Denison 800 Series Variable Volume Piston Pump—shown below with handwheel control.*

With Denison Variable Volume Axial Piston Pumps powering your hydraulic checkout equipment, you assure *high-accuracy simulation.*

These pumps (with volumes to 116.7 gpm and pressures to 5000 psi) allow a wide range of pressures and flows to be selected with fine-line variations. You get the multi-purpose flexibility needed for today's checkout equipment.

Denison Variable Volume Piston Pumps—and *all* Denison hydraulic components—are precision manufactured for long, maintenance-free life. Result—you can spend more time checking-out... less time checking-up.

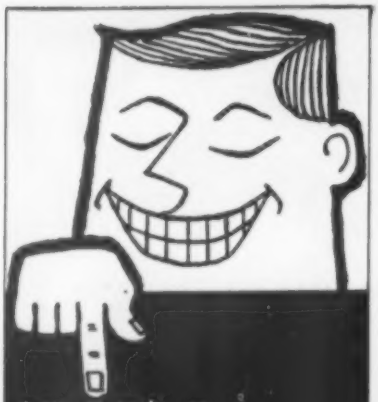
Ask your Denison Hydraulics Specialist—located in all principal cities—to show you how Denison hydraulic equipment—pumps, motors, valves, controls—can help you improve the performance of your GSE systems.

Write for your copy of new Bulletin 204, "Advanced Hydraulic Components For Ground Support Equipment".

DENISON ENGINEERING DIVISION
American Brake Shoe Company
1166 Dublin Road • Columbus 16, Ohio

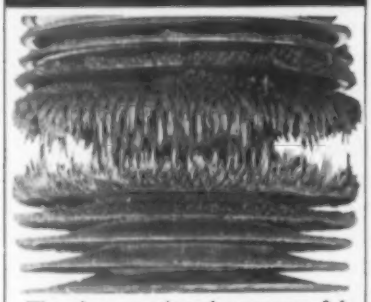
HYDRAULIC PRESSES
PUMPS • MOTORS • CONTROLS

DENISON
HYDRAULIC POWER



meet a strainer with a magnetic personality

Ripley Magnetic Sump Strainers combine powerful built-in Alnico magnets with efficient, removable filter discs for 2 way protection—all in one compact unit!



The above section shows powerful magnetic attraction of the entire strainer assembly. Designed to meet J.I.C. Specifications for magnets in hydraulic systems . . . these Ripley Strainers require no extra openings in the reservoir, and disassemble for quick, easy cleaning. They are available now in a wide range of sizes. Write today for complete data!

RIPLEY

SCREEN AND STRAINER CO.

Filter Division

32749 Northwestern Hwy., Farmington, Mich.

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BRIEFS

Jim Fisher, chairman of the component classification committee presented a numercial identification system that classifies fluid power components. This giant project is a big step to give uniformity in organizing marketing, sales, directory and catalog information about hydraulics and pneumatics. It also establishes a universal numerical identification system.

• **Market Data**—An imposing review of reports presented during the past seven years on markets was given by R. L. Firth. Research, product planning, sales management, and distributor relations are among the activities of NFPA's marketing board.

Among projects being worked on are:

- geographical distribution of fluid power markets and methods for evaluation and assignment of sales territories
- marketing problems created by foreign competition
- confidential sales statistic service
- appraisal of industry markets and products

Barrett Rogers is NFPA's executive vice president and secretary with headquarters at 5595 N. Hollywood Ave., Milwaukee 17, Wis. ▼▼▼

Ross Features Working Exhibits

At the recent ASTME Tool Show in Detroit, Ross Operating Valve Co.'s exhibit highlighted a working model of an air-controlled conveyor loop in an automatic foundry. It simulated a foundry cleaning station. Five small, flat-top trucks moved continuously around a 4' x 8' track system in a selected, varied pattern. Each truck carried a different version of the Ross Pacer solenoid valve. Fourteen of these 3 and 4-way valves actuated the small cylinders which operated the system. As the trucks with their "castings cargo" moved in from the foundry, they were fed to cleaning and grinding stations on short lines within the rectangle. The trucks then went to the inspection area. (In the foundry, a casting circulates through the loop until it passes inspection.) Action was traced on lighted JIC symbols on a glass panel.

Working exhibits helped engineers evaluate ways to control and operate machines with air. ▼▼▼

More Briefs on page 44

interchangeable with all standard JIC cylinders

With the introduction of the ALL NEW T-J Squair Head, Tomkins-Johnson now offers industry the most complete design range of air and hydraulic cylinders. Presently available in bore diameters from 1½ to 8 inches, the T-J Squair Head is an interchangeable cylinder which produces maximum force and efficiency, with minimum pressures... and is also adaptable to the use of low pressure oil as the working medium. Write to The Tomkins-Johnson Co., Jackson, Michigan, for Bulletin #SQ 10-58 and complete details.

CHECK THESE 10 POINTS OF T-J SUPERIORITY

1 One Piece Piston

2 Hard Chrome Cylinder Bore and Piston Rods

3 High Tensile Steel Tie-Rods

4 Cushion Adjusting Screw, Externally Adjustable

5 New Super-Cushion for air, or Self-Aligning Master Seal for Oil (T-J Patents)

6 Solid Steel Heads and Mounting Plates Standard all Models

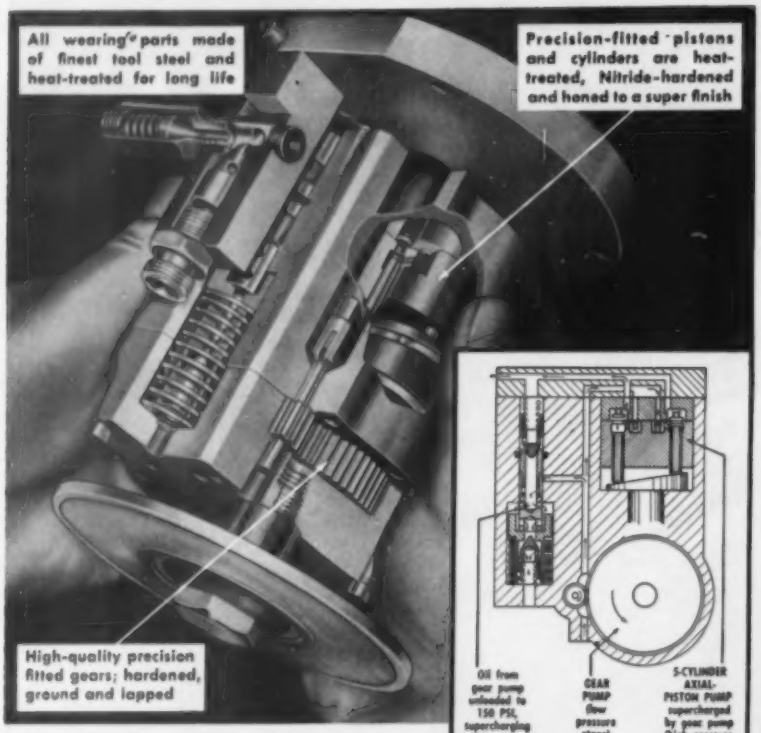
7 Port Design Allows Minimum Pressure Drop on Inlet or Outlet

8 Chevron Type, Self-Adjusting Rod Packing

9 Piloted Packing Gland—Absolute Alignment

10 Piston Rod, Extra Strong—Polished and Chrome Plated for Efficiency and Protection

T-J TOMKINS-JOHNSON


All wearing parts made of finest tool steel and heat-treated for long life
Precision-fitted pistons and cylinders are heat-treated, Nitride-hardened and honed to a super finish
High-quality precision fitted gears; hardened, ground and lapped
Oil from gear pump unloaded to 150 PSI, supercharging piston pump
GEAR PUMP (low pressure stage)
5-CYLINDER AXIAL-PISTON PUMP supercharged by gear pump (high pressure stage)

For operating pressures up to 10,000 PSI

New, unique 2-stage hi-pressure hydraulic pumping unit—dual-volume, dual-pressure

- **DELIVERS HIGH-VOLUME AT LOW PRESSURE**
- **2.6 GPM @ 100 PSI**
  1.75 GPM @ 500 PSI
  80 CU. IN./MIN. @ 1,000 PSI
  50 CU. IN./MIN. @ 10,000 PSI

The new and modern OTC "Vanguard" hi-lo hydraulic power package is a precision-built, high-quality unit meticulously crafted for dependable performance and long life. To best utilize the "Vanguard's" exceptional performance, a wide range of accessories are available: your choice of several motors, gasoline engine, 2 and 4-way lever-control valves, 2-way solenoid valve, pressure switch, pressure regulating valve, manifold, reservoirs, gauges, etc.

For detailed information on this advanced, new unit, write:

PRECISION HYDRAULICS DIVISION
OWATONNA TOOL CO.
710 CEDAR STREET OWATONNA, MINNESOTA

Circle **100** on Time-Saver Card

BRIEFS

Big Clamps Lift and Turn 27,500-lb Load

In Venezuela, a lift truck picks up loads of concrete bridge piling, lifts them eighteen feet and rotates them 90 deg. The clamps

handle loads from 24" to 61" diameter. Each clamp is faced with 24 rubber pads. Hydraulic cylinders rotate the clamping unit on two 11" roller bearings, and operate the clamps. The truck is over 24 feet to the top of the upright. Weight exceeds 30 tons. Manufacturer is Hyster Co., Portland, Oregon. ▼▼▼

30-Ton Press Bends Tubing to 3" Diameter

This new hydraulically-operated press can make complex bends faster, in one tooling setup and one pass through the press. Increased productivity is possible because of its open design which features an offset ram, offset wing die holders, and side-mounted wing die cushion cylinders. It bends steel tubing equivalent to 3" OD x .125" wall and laminated tubing to 2½" diam-

Continued on page 46

Circle **139** ➔

ACTUAL SIZE

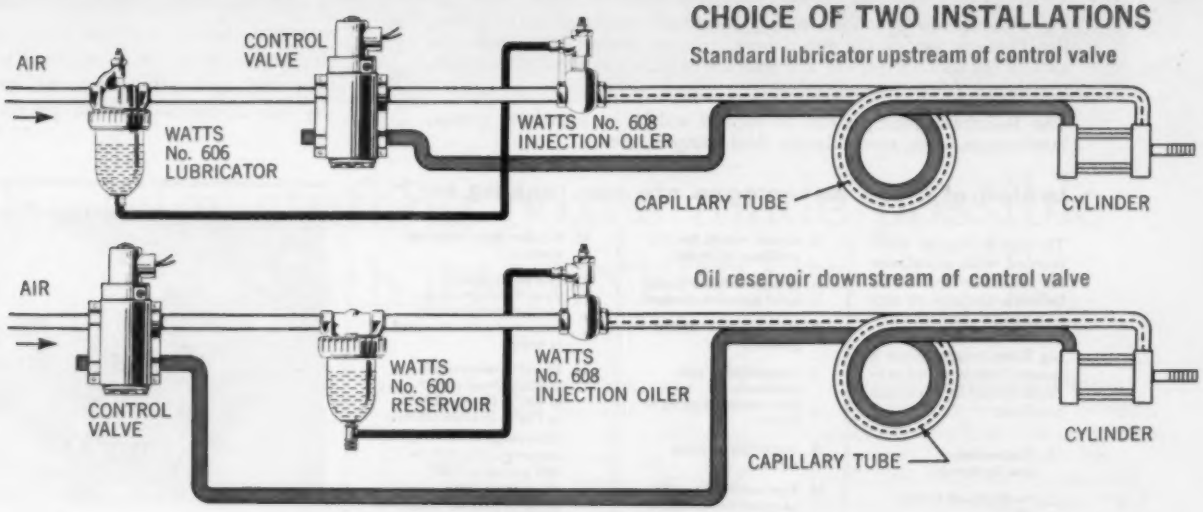
WATTS No. 608

1/4"-3/8"

AIR-CYLINDER INJECTION OILER

Solves the problem of lubricating low volume, short stroke cylinders

CHOICE OF TWO INSTALLATIONS



Most low volume, short stroke air cylinders are impossible to lubricate properly by ordinary mist-type lubrication because of their low air consumption.

The solution is *controlled* oiling—*direct to the cylinder*. It's the *only* way to assure positive lubrication for long cylinder life.

Installed in the pressure line between control valve and air cylinder, Watts' new No. 608 Injection Oiler is designed specifically to deliver metered oil direct to the cylinder through a capillary tube located within the cylinder air supply line.

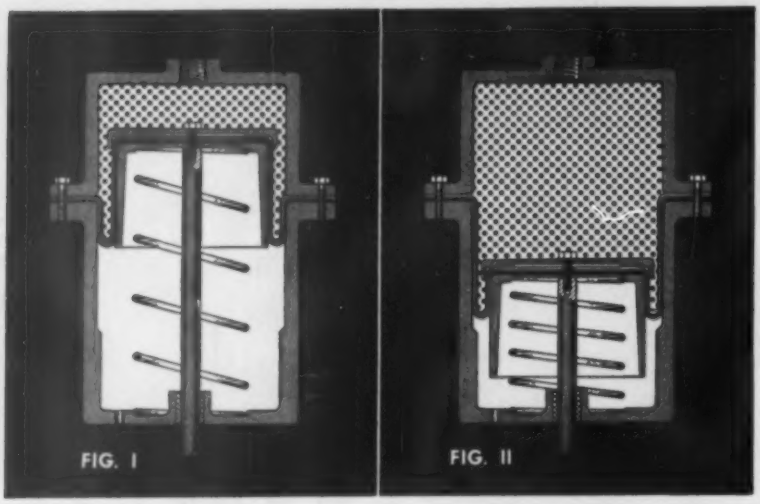
Find out about the Watts Injection Oiler. Available in kit form (K608), includes No. 608 oiler, 2 ft. oil supply hose and 16 ft. capillary tubing.

Write *Watts Regulator Company, Industrial Division, Lawrence, Massachusetts.*

FILTERS
REGULATORS
LUBRICATORS

YOUR SAFE SPECIFICATION

WATTS



For Hydraulic and Pneumatic Applications

Nothing rolls like a Bellofram® Rolling Diaphragm. It's frictionless!

The Bellofram Rolling Diaphragm provides ultrasensitive response in hydraulic or pneumatic devices where frictionless, long-stroke action in small-diameter configurations is required . . . and where flex life of millions of cycles is necessary.

These desiderata are achieved through the *rolling* action of a flexible thin-sidewall diaphragm consisting of a high-tenacity fabric overlay embedded in elastomeric material.

Fig. I shows how Bellofram Rolling Diaphragm conforms to the piston. Fig. II shows how, as the piston descends under pressure, the diaphragm *rolls* off the piston's sidewall and onto the cylinder's sidewall in a smooth, continuous, frictionless movement.

The Bellofram principle can be applied widely in actuators, pumps, instruments, seals, accumulators, fluid dampers, etc.

Which of these advantages are you looking for?

To the designer confronted with situations for which conventional bellows, O-rings, or cup packings are inadequate, Bellofram Rolling Diaphragm offers a constellation of advantages found in no other product:

1. Friction-free (low hysteresis).
2. No break-out friction effects.
3. Completely leakproof device.
4. Constant area in all piston positions.
5. Almost infinite flex life (millions of cycles).
6. Sensitivity to extremely small pressure changes.
7. No mechanical spring gradient.
8. Compatibility with practically all environmental gases or fluids.
9. Automatic de-icing action.
10. Free positioning with complete relaxation at any point in its stroke.
11. Does not require close machine finish tolerances on pistons and cylinders.
12. Freedom from abrasive wear.
13. One hundred stock sizes. Four mounting configurations. Special types and sizes designed to order.
14. Excellent temperature stability, from —85°F. to 350°F. (from —120°F. to 700°F. in some cases).

Wide range of working pressures: 1 in. H_2O to 500 psi (up to 1200 psi in some cases).

Effective pressure areas from .028 to 108 sq. in.

Cylinder bore diameters from .25 to 12 in.

Extended range of stroke (.01 to 12 in.).

Send for Free Literature

Bellofram®

®Reg. trademark U.S.A. and foreign countries • Bellofram Rolling Diaphragms are protected by U.S.A. and foreign patents.

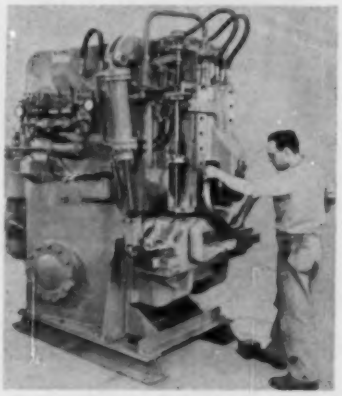
BELLOFRAM CORPORATION, 35 BLANCHARD ROAD, BURLINGTON, MASSACHUSETTS

BRowning 2-2100 Mission 3-9000

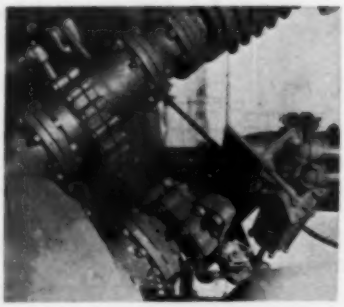
Circle **23** on Time-Saver Card

BRIEFS

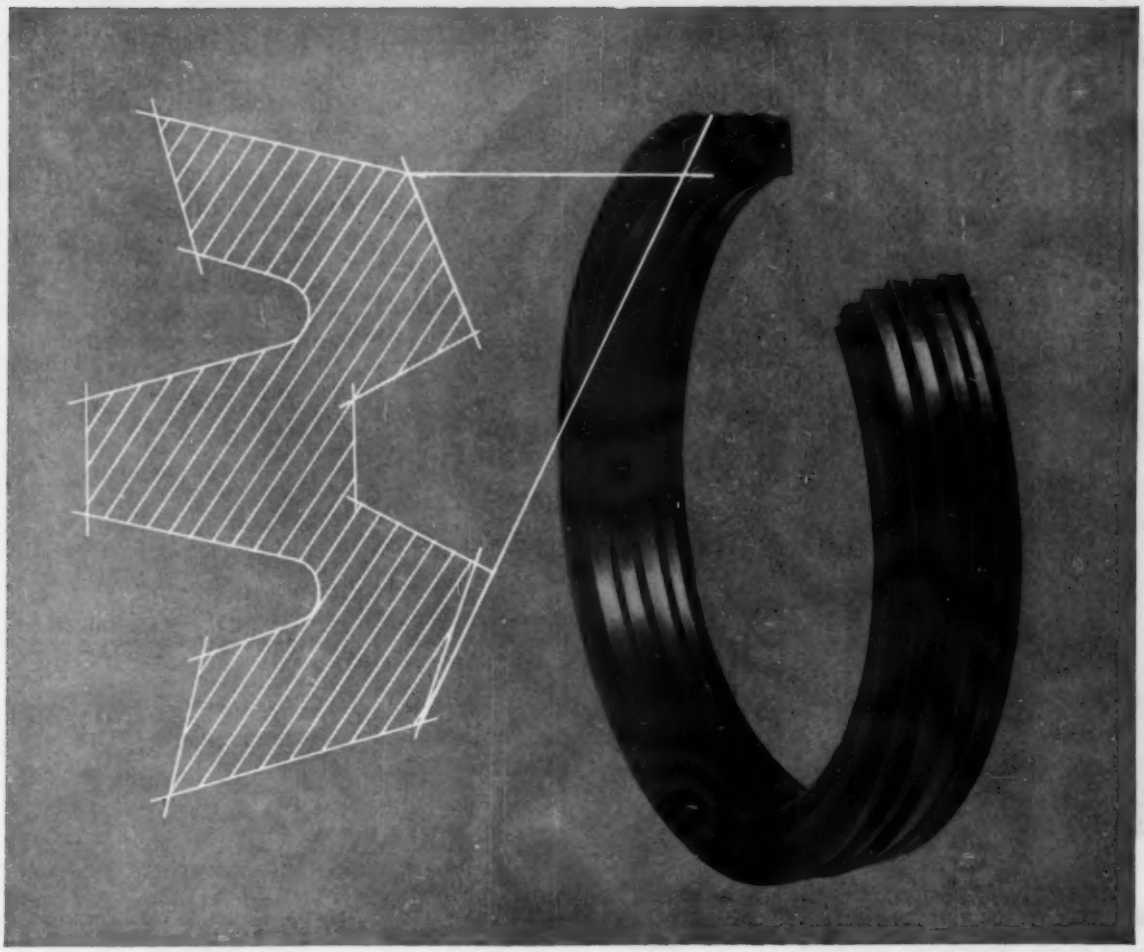
eter. It produces up to 800 bends per hour. Fast cycling is provided with the 10-station angle-of-bend turret, with pickout adjustable pins, which automatically returns to its starting position after completing a pre-selected number of



bends. This Pines Model 30-T Press requires a floor area of 48" x 84". The 125-gal hydraulic reservoir is in the machine base. A high volume of oil is supplied to the ram and wing die cylinders by two 20-hp motors and pumps. ▼▼▼



AIR CYLINDERS OPERATE BIG GATE VALVES on the vent and exhaust ports of a pneumatic activator. The activator fluidizes coke at Tidewater Oil's Delaware City refinery. When activator air pressure reaches 40 psi, the fluid coke discharges through a 6" valve. The coke is pneumatically conveyed to a nearby power plant. When pressure drops to 18 psi, a 4" valve opens the activator to the atmosphere. Each valve has a spring-loaded sealing disc which slides over a flat seal face. The air cylinders supply enough force to operate the self-lapping valves under extreme heat and abrasion.



Smaller stuffing boxes made possible with J-M UNEEPAC®

THIS UNIQUE CROSS-SECTION SHOWS WHY UNEEPAC AFFORDS FULLY AUTOMATIC SEALING IN LIMITED SPACE

Because Uneepac offers compact design and greater efficiency...smaller stuffing boxes and fewer rings are required to seal against the most rugged conditions!

These fully automatic, self-centering and self-adjusting packings are pressure-actuated. They are easy to assemble... are quickly installed... fit accurately... reduce friction... give exceptional service life in rod and piston applications.

Skillfully compounded in whatever materials best meet your requirements, J-M moulded packings are engineered with the workmanlike care and precision for which Johns-Manville is known throughout industry. They are specifically designed to give you top performance and optimum economy for every packings dollar you spend.

There is a broad selection of J-M moulded packings specifically engineered for hydraulic and pneumatic applications. A complete range of all standard sizes, styles and materials is available for immediate shipment. Or J-M will custom-make and design the exact packing that will give you the best, most economical service.

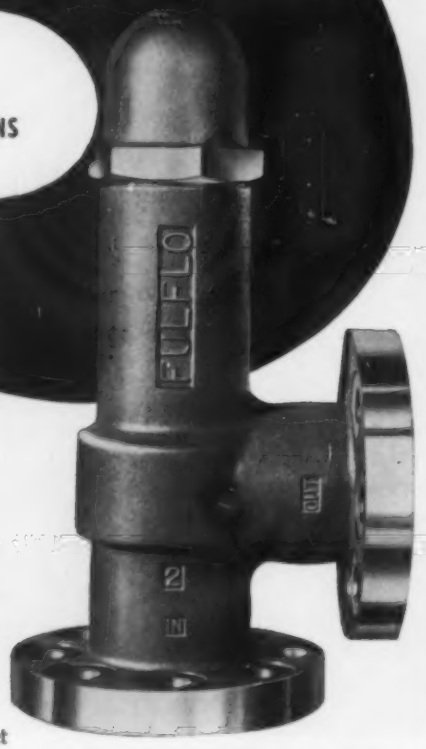
You'll find complete information in free booklets PK-126 A and PK-148 A, which present all J-M moulded packings materials and designs, with specific recommendations for most applications and service conditions. See your J-M Distributor. Or write to Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario.

JOHNS-MANVILLE JM PRODUCTS

POSITIVE AUTOMATIC PRESSURE CONTROL?

CHECK YOUR REQUIREMENTS AGAINST FULFLO SPECIFICATIONS

- ✔ Screw or flange models
- ✔ Pressures to 500 pounds
- ✔ Pipe sizes to 3"
- ✔ Steel, cast iron or brass bodies
- ✔ Brass, steel or stainless trim
- ✔ All-steel for extra safety



FULFLO gives you what you want in safe, trouble-free and quiet operation for any hydraulic system. Shear-closing action eliminates chattering; sliding piston gives full flow opening; distinctive construction allows easy adjustment within the valve's pressure range or change of the pressure range.

Whatever your requirement . . . for O.E.M. use or replacement service . . . there's a FULFLO Oil By-Pass Relief Valve designed just right, built right and priced right, too!

NEED A "Special"?

FULFLO can engineer a special valve to your most exacting requirements. Examples of "specials" are shown in Data Book.

FOR EXTRA CONVENIENCE

Where frequent pressure setting adjustment is needed, install a FULFLO Hand Wheel Valve. Made in a variety of styles.

FOR COMPLETE INFORMATION, request a copy of the FULFLO Valves Mechanical Data Book with complete specifications and engineering data.

TRADE MARK "FULFLO" REG. U.S. PAT. OFF.

THE FULFLO SPECIALTIES CO., INC.

415 Fancy Ave. Blanchester, Ohio

Circle **51** on Time-Saver Card

FUTURE EVENTS

MACHINE TOOL EXPOSITION & MEETING
September 6-16
International Amphitheatre
Chicago, Illinois

PRODUCTION ENGINEERING SHOW
September 6-16
Navy Pier
Chicago, Illinois

ASME JOINT AUTOMATIC CONTROL CONFERENCE
September 7-9
Massachusetts Institute of Technology
Cambridge, Mass.

2ND COLISEUM MACHINERY SHOW
September 7-15
Chicago Coliseum

ASME RUBBER & PLASTICS CONFERENCE
October 9-12
Lawrence Hotel
Erie, Pa.

SAE A-6 COMMITTEE MEETING
(Aircraft & Missile Hydraulic & Pneumatic Systems & Equipment)
Week of October 17
San Francisco, Calif.

ASME-ASLE LUBRICATION CONFERENCE
October 17-19
Statler Hilton Hotel
Boston, Mass.

16TH NATIONAL CONFERENCE ON INDUSTRIAL HYDRAULICS
October 20-21
Sherman Hotel
Chicago, Illinois
For additional information, contact Leroy A. Wickstrom, Illinois Institute of Technology, Chicago 16, Illinois

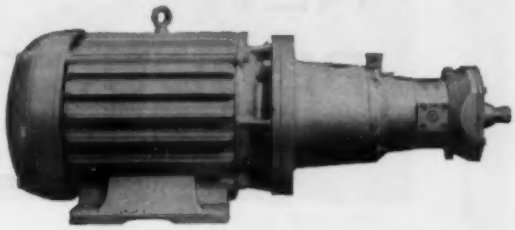
NATIONAL FLUID POWER ASSOCIATION FALL MEETING
October 31-November 2
Edgewater Beach Hotel
Chicago, Illinois

1ST NATIONAL DIE CASTING EXPOSITION & CONGRESS
November 8-11
Detroit Artillery Armory

ASTME WESTERN TOOL SHOW
November 14-18
Los Angeles Memorial Sports Arena

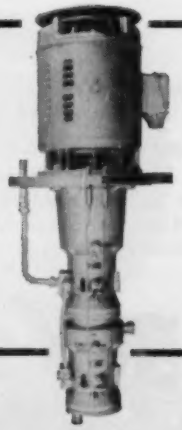
1

This is a Towler axial plunger oil pump, size A4, which discharges 14.8 cu. ins/sec. up to 5500 psi. at 1730 rpm. It can be supplied motorised as shown.



2

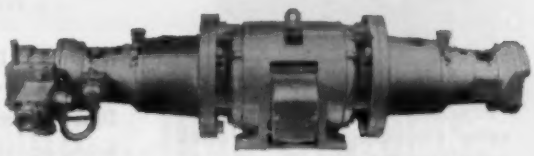
Two axial pumps can be mounted in tandem, one driven through the other. This example shows a motorised size A4TA4 pump fitted to a tank mounting flange, ready to drop into a tank (which is supplied if required)



3

A vane pump (L Series) is available built onto the axial pump. In this example the vane pump is fitted with a relief and unloading valve. From right to left, the combination shown here is A1CL-Motor-A4L96.

Vane pump discharges, up to 1000 psi, are 25, 41 cu. ins/sec. at 1730 rpm. and 49,77 cu. ins./sec. at 1150 rpm.



4

Towler axial pumps are available with discharges (Series A) up to 22.2 cu. ins/sec. at 5500 psi. at 1730 rpm; or (Series XA) 14.8 cu. ins./sec. at 9000 psi. 1730 rpm. They are also available for face and foot mounting, packaged in or on a tank; there is a full range of valves, and excellent high pressure system design service is available.

it all adds up to TOWLER VERSATILITY

ELECTRAULIC
PUMPS
CONTROLS
AUTODRAULIC

TOWLER BROTHERS
(PATENTS) LTD. RODLEY, LEEDS, ENGLAND
Tel: Pudsey 3125/6/7/8 Grams: 'Electrolic' Rodley

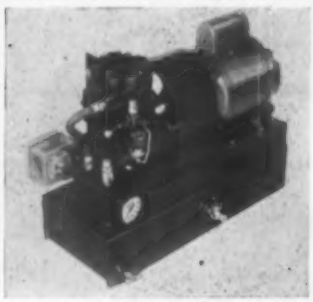
NEW PRODUCTS

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.

AIR COMPRESSOR
. . . rated at ⅓ hp

Designation: Automatic Air Plant

Features: Forced-feed oil pressure lubrication. Self-contained air cooling fan. Motor and compressor are resilient-mounted. Leaf-type exhaust



valve eliminates need for check valve. Direct coupling of pump and motor. Rectangular steel welded tank has internal baffles. Unit has moisture drain cock, automatic start-stop air-pressure switch, gage, heavy-duty fittings, air outlet needle valve.

Specifications: 18″ x 12″ x 15″. Weighs 55 lb. Piston displacement is 2.70 cfm at 1/3 hp, 1725 rpm. Operating range is 100 psi. Tank has 3-gal capacity.

Ajax-National Air Compressor Div.
Ajax Equipment & Electric Co.
New York, N. Y.

Circle **300** on Time-Saver Card

POWER UNITS
. . . are air-operated

Designation: SC 40-500, SC 40-600

Features: Built-in pilot valve keeps

pump from stalling. For oil or water hydraulics and static and burst-pressure testing. Connections to air, fluid supply, and work. Two pressure ports, one equipped with valve, provide ease of control. Air-piston actuating valve is automatically positioned on power stroke. Valve assembly is precision-fitted.

Specifications: SC 40-500 has 10 models for 500 to 25,000 psi. SC 40-600 has 8 models for 1000 to 30,000 psi. Capacities from 3 gpm at 500 psi, to 20 cipm at 30,000 psi. Require 100 psi.

SC Hydraulic Engineering Corp.
Los Angeles, Calif.

Circle **301** on Time-Saver Card

HYDRAULIC PUMP
. . . is worm driven

Designation: 853 W/M

Features: Horizontal, triplex ram pump. Low plunger speeds. All

steel. Foot-mounted. Fabricated base plate has skid ends and welded-in tubes.

Specifications: 5′ x 1′ 10″ x 1′ 8″. Delivery is ¾″ BSPT, suction 1″ BSPT. Delivers 5 gpm at 1000 psi, 5 motor bhp, 960 rpm. Delivers 7.5 gpm at 1400 psi, 10 motor bhp, 1440 rpm.

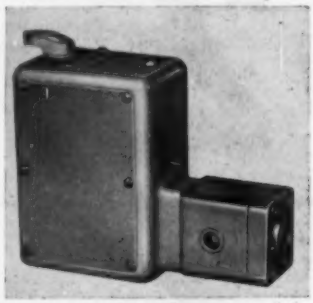
Joseph Evans & Sons (Wolverhampton)
Culwell Works, Wolverhampton,
Staffs., England

Circle **302** on Time-Saver Card

SOLENOID VALVES
. . . high pressure, poppet type

Designation: SV-1 (2-way)

Features: Normally open 2-way valve for 1000 to 9000 psi. Poppet construction reduces frictional heat. Valve is mounted directly on power unit and requires only one line to actuator. Available in 3-way and



4-way types in wide range of frequencies for pressures to 6000 psi.

Specifications: Weighs 8 lb. Size 3¼″ x 7″ x 8½″, 60 cycle. Available with either hand or foot switch.

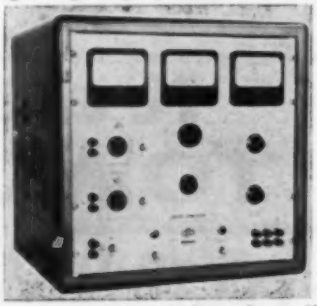
Manco Mfg. Co.
Bradley, Ill.

Circle **303** on Time-Saver Card

SERVO ANALYZER
. . . for servo design, production check-out

Designation: Model 203

Features: Provides direct read-out for damping ratio. Direct reading and automatic plotting of amplitude ratio and phase angle. Provides analog output proportional to log



frequency, phase shift, and amplitude ratio in db. Records Bode plots, Nyquist diagrams, and Nichols' charts. Semi-skilled technicians can perform go-no-go testing to isolate

Continued on page 52

Jet brake cup — LS-53
Synthetic lube diaphragm — LS-53
Diesel equipment seal — Viton
Drop-off tank seal — LS-53
Chemical pump liner — Viton
Natural gas valve diaphragm — Viton

For advanced fuel...hydraulic...lube systems,

New materials prove ideal in handling temperature extremes −350° F. to +750° F.

Working with two remarkably versatile elastomers, C/R Sirvene engineers are producing flexible molded parts for many vital fuel, lubricating, hydraulic and pneumatic systems. One, Viton-A*, can be compounded to produce parts that function dependably at 600° F., and for short periods up to 750° F. The other important feature of Viton compounds is their excellent resistance to corrosive chemicals, chlorinated solvents as well as both synthetic and petroleum base fuels and lubes. At the other extreme, C/R compounded Silastic LS-53** parts are providing low temperature operation down to -80° F. They also exhibit excellent resistance to synthetic and petroleum base fluids up to 350° F., and function well in propane up to 500° F. For temperatures as low as -350° F., C/R recommends Teflon* compounds.

C/R Sirvene engineers have an intimate knowledge of these elastomers. They also have perfected special techniques in processing which still further improve the physical properties of the molded parts. If your problem involves high or low temperatures, close tolerances, and compatibility in advanced design fuel, lubricant or hydraulic systems, get in touch with us at once. We have the skill and the facilities to help you.

* DuPont registered trademark
**Dow-Corning registered trademark

CHICAGO RAWHIDE MANUFACTURING COMPANY

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Export Sales: Geon International Corp., Great Neck, New York
C/R PRODUCTS: **C/R Shaft & End Face Seals • Sirvis-Conpor mechanical leather cups, packings, boots • C/R Non-metallic gears**

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THE VERY FINEST AND YOU GET IT FROM

B-H-E-W! If your job application demands precision hydraulic cylinders and you insist upon better on-the-job results, always *demand* B-H-E-W products! Only B-H-E-W offers designs and basic design techniques plus the added advantage of a complete staff of trained specialists to analyze your specific application. *You* benefit because *you* obtain B-H-E-W products at production prices which are precision-manufactured to produce the highest level of performance!

PRODUCTION PARTS SAVE YOU MONEY, DO THE JOB BETTER! B-H-E-W basic cylinders can easily be modified to fit your *specific* product applications. *You* benefit from production economies; you get custom-built cylinders!

BHEW's 3000 psi SERIES GENERAL-PURPOSE CYLINDERS, designed around component parts but custom-built to *your* specifications, are available in a variety of mountings, in sizes 1½" through 6", with adjustable or non-adjustable rod ends or without rod ends. These are rugged cylinders for O.E.M.

DISCUSS YOUR DESIGN AND APPLICATION PROBLEMS WITH US!

WRITE TODAY for free Hydraulic Cylinder Engineering Reference data. 78 dimensional basic designs for general purpose and special double- and single-acting cylinders. SAVE TIME!

BH EW

INTEGRITY · CHARACTER · QUALITY

BENTON HARBOR ENGINEERING WORKS, INC.

622 Langley Avenue • St. Joseph, Michigan

Circle **25** on Time-Saver Card

NEW PRODUCTS

defective components. Unskilled personnel can perform acceptance tests on servo equipment.

Specifications: Frequency range is 0.5 to 50 cps (2% accuracies). Phase angle is ±180 deg. (±2-deg accuracy). Reads amplitude ratio over ±40-db range (±0.5-db accuracies). Basic carrier frequency is 400 cps. Operating signals are ac (modulated carrier) or dc (servo frequency signals).

Metrolog Corp.
Subs. Air Logistics Corp.
Pasadena, Calif.

Circle **304** on Time-Saver Card

AIR CYLINDERS . . . are single-acting

Features: Rolled-in construction on front and rear heads. Wall thickness increased 50%. ⅜-18 hex nut

for front nose mounting. Mirror finish stainless steel body. U-cup mounted in aluminum-alloy piston. Spring return.

Specifications: 1-1/16" bore. Strokes to 3".

Bimba Mfg. Co.
Monee, Illinois

Circle **305** on Time-Saver Card

POLYETHYLENE TUBING . . . in four sizes

Designation: Parker-POL

Features: Cut with knife or shears. Connect with brass or aluminum Intru-lok fittings. Insert into fitting, tighten fitting nut. For some cor-

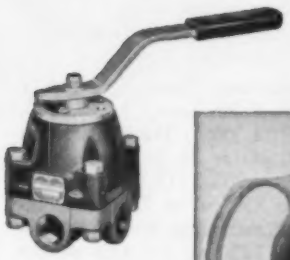
Continued on page 54

For High Pressure (to 10,000 P.S.I.)

MANUAL WATER VALVES

that last

Specify " SHEAR-SEAL " design



4-Way, Manipulator, Dual pressure and Shut-off Valves from ¼ to 1½" N.P.T.

Note the mirrorlike sealing surfaces on this Dual Pressure Valve rotor after 4 years of service.

On extrusion presses, die casting machines, rubber and plastic molding presses and on blowout preventers, they have performed without maintenance longer than any other type of valve.

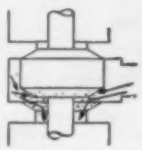
This LONG, MAINTENANCE-FREE SERVICE is possible because the metal-to-metal sealing surfaces are self-aligning and actually improve with use through continued lapping action. Sealing qualities do not diminish because a spring compensates for the wear.

DIRT CANNOT SCORE SEALS because flow is through "Shear-Seals," sealing surfaces remain in constant intimate contact.

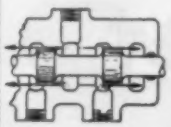
COMPLETE CONTROL OF YOUR CIRCUIT because "Shear-Seal" design is excellent for throttling. It permits opening to any desired degree of flow with smooth action and without fighting fluid pressure.

The "Shear-Seal" action eliminates line surges and the round tubular flow passages provide more flow and velocity capacity (up to 60 ft. per sec.) because they are unobstructed by spools or poppets.

This is why we don't use **SPOOL OR POPPET DESIGN**



Poppets score



Spools leak

Write for Catalog V-59-60

CONTROL VALVE DIVISION

barksdale valves

5125 ALCOA AVENUE • LOS ANGELES 58 • CALIFORNIA

Circle **17** on Time-Saver Card

10,000 P.S.I. SOLENOID VALVES

Important: These valves are standard catalog items.

● They are available for immediate delivery (in stock) at standard valve prices, for a service which generally requires costly (made-to-order) special valves.

● Shut off and 4-way valves in ¼, ⅜ and ½ inch port sizes are rated for 10,000 P.S.I. liquid or gases. They will withstand surges of up to 15,000 P.S.I. without damage to the valves' sealing qualities (designed for a burst pressure of 30,000 P.S.I.).

Solenoids are available for 115, 230 and 460 volt A.C. operation.

● Long maintenance-free service is achieved through the leak-proof "Shear-Seal" design. Optically flat metal to metal sealing surfaces (of the self-aligning sealing rings and the mating rotor face) are protected by staying in constant intimate contact: flow is always through the center of the "Shear-Seals," never across sealing surfaces. Sealing qualities actually improve as the seals lap themselves to a more perfect fit with each valve operation. There is no external shaft leakage because the pressure is confined to the flow passages.

For complete data write for catalog S-10000.

CONTROL VALVE DIVISION

barksdale valves

5125 ALCOA AVENUE • LOS ANGELES 58 • CALIFORNIA

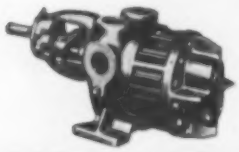
Circle **18** on Time-Saver Card

WHATEVER YOUR REQUIREMENTS FOR ROTARY PUMPS, THERE'S A ROPER TO DO THE JOB

Series T .3 to 55 GPM
Choice of 192 Models

Pump and motor units . . . pump serves as end bell of motor. Require minimum space . . . easily installed . . . no coupling required . . . mount in any position. Each unit approximately same size as NEMA motor of HP required for driving. Open drip proof or totally enclosed motors; single or three phase as required.

ROPER
ROTARY PUMPS



ROPER
ROTARY PUMPS

Series F 1 to 300 GPM
Pressures to 300 PSI

Feature helical steel pumping gears, hardened steel shafts, bronze flange-type bearings. 4-port design with 8 optional piping arrangements (4 for CW and 4 for CCW rotation) solves installation problems. With or without built-in relief valve in either mechanical seal or packed box construction.

Series K ¾ to 50 GPM
Pressures to 150 PSI

Extremely compact in all sizes. Helical pumping gears are hardened steel, with steel shafts and bronze bearings. Sizes 10 through 50 GPM have patented venturi suction and discharge principle for smooth flow and quiet operation. With or without built-in relief valve; packed box or mechanical seal.

ROPER
ROTARY PUMPS

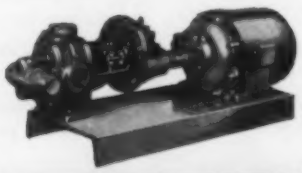
ROPER
ROTARY PUMPS

Series H 5 to 75 GPM
Pressures to 1000 PSI

Designed to operate at direct motor speeds. Used for all types of hydraulic mechanisms where high pressures are required. Hardened steel spur gears for maximum efficiency, and heavy duty roller bearings and bronze wear plates for long life service. Mechanical seal or packed box.

Series 3600 40 to 300 GPM
Pressures to 100 PSI

Handle thick or thin liquids at slow speeds. Operate in either direction. Hardened iron pumping gears, hardened steel shafts, heavy duty bronze sleeve bearings. Mechanical seal or packed box. Series includes tank truck pumps as well as single motor driven units with gear reduction.



ROPER
ROTARY PUMPS

Send for
"How to Solve Pumping Problems"

Roper Hydraulics, Inc. COMMERCE, GEORGIA
Manufacturers of Standard, Special and Custom Pumps for All Industries

Circle **113** on Time-Saver Card

NEW PRODUCTS

rosion applications, use stainless steel Ferulok fittings. Joints withstand severe vibration and tube movement. Chemically-resistant, nontoxic, odorless. Not attacked by vermin. Use on instrument panels, for temporary lab set-ups, and for short spans around units in fluid-handling system.

Specifications: Sizes: ¼" OD x .040" wall thickness; 5/16", ⅜", and ½" x .062". Tensile strength is 2300 psi at 70 F. Temperature range is —90 to 175 F. Burst pressures to 450 psi at 75 F. Recommended maximum working pressures to 125 psi. ½" OD weighs 3.60 lb. per 100 ft.

Parker Fittings & Hose Div.
Parker-Hannifin Corp.
Cleveland, Ohio

Circle **306** on Time-Saver Card

HYDRAULIC POWER PACK . . . for 6000 psi

Designation: Hy-Pac

Features: Tool-steel wearing parts set in aluminum casting. Direct

drive. Built-in 2-way valve, relief valve.

Specifications: For 6000 psi continuous, 10,000 psi intermittent. ¾-hp, 1750-rpm motor uses 115/220 v, 60 cps, single-phase. Weighs 55 lb. Heavier-duty pumps operate at 1 to 10 gpm to 20,000 psi.

Hydraulics, Inc.
Milwaukee, Wis.

Circle **307** on Time-Saver Card

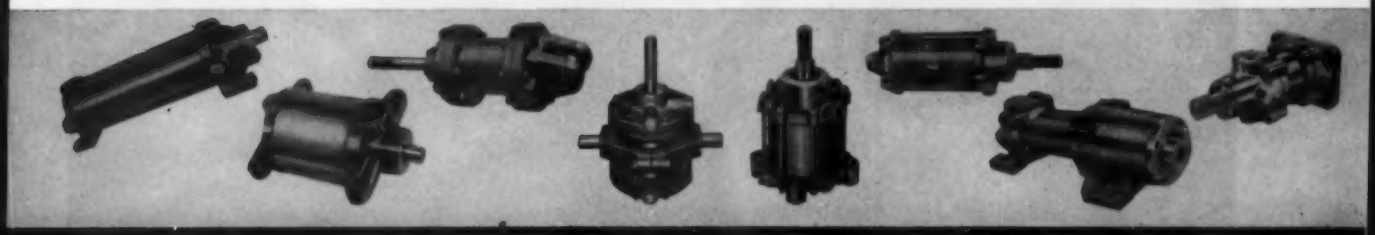
For more NEW PRODUCT reviews turn to page 130

Experience proved in every major industry . . . ANKER-HOLTH

POWER CYLINDERS SAVE YOU°TIME, TROUBLE AND MONEY

Select your needs

from the World's Widest Selection of Standard Cylinders



Check these compelling reasons why Anker-Holth air and hydraulic power cylinders save you time, trouble and money – widest selection of standard models | reliability through military accepted quality control program | simplified maintenance | all mountings available | bores 1" to 30" | strokes to 40' | built to JIC specifications | nationwide engineering service on call | complete facilities to engineer any power cylinder application outside the standard model.

Only a few models could be shown above

This free catalog shows them all

ANKER HOLTH

DIVISION, THE McDOWELL-WELLMAN COMPANIES

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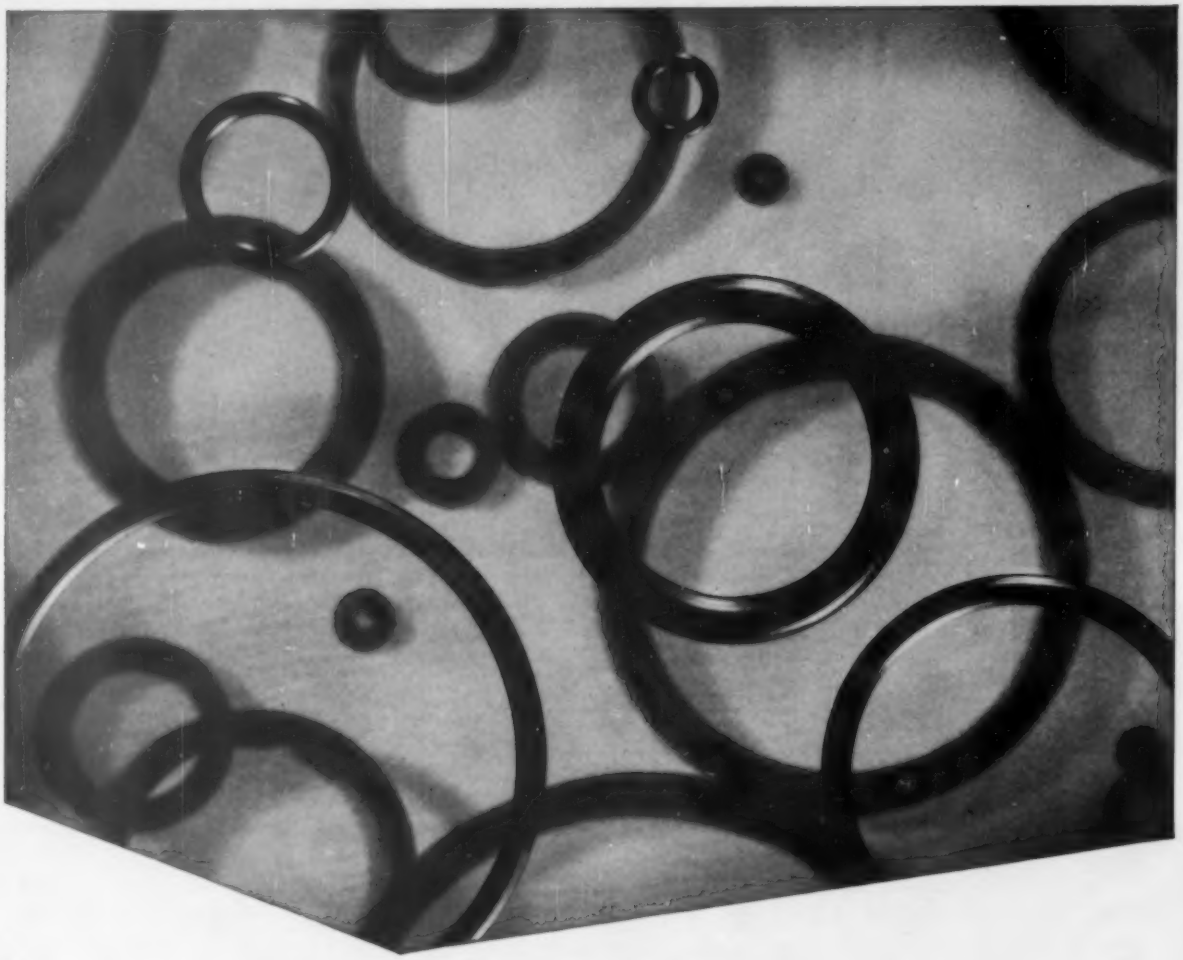

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These Materials Available: Standard Buna-N Rubber • Viton • Teflon • Silicone Rubber • Butyl Rubber • Military Spec. Series: MIL P5516A, MIL P5315A, MIL G5510A, MIL P25732, MIL R25897, AMS 7270, AMS 7271 and AMS 7274 • Teflon and Leather Back-up Washers.

All O-Rings Available in Series 6227, 6230, 6290 and 29513.

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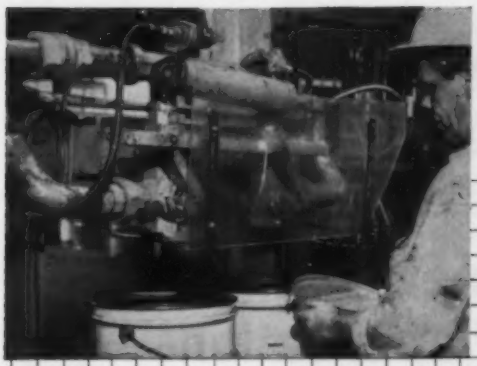
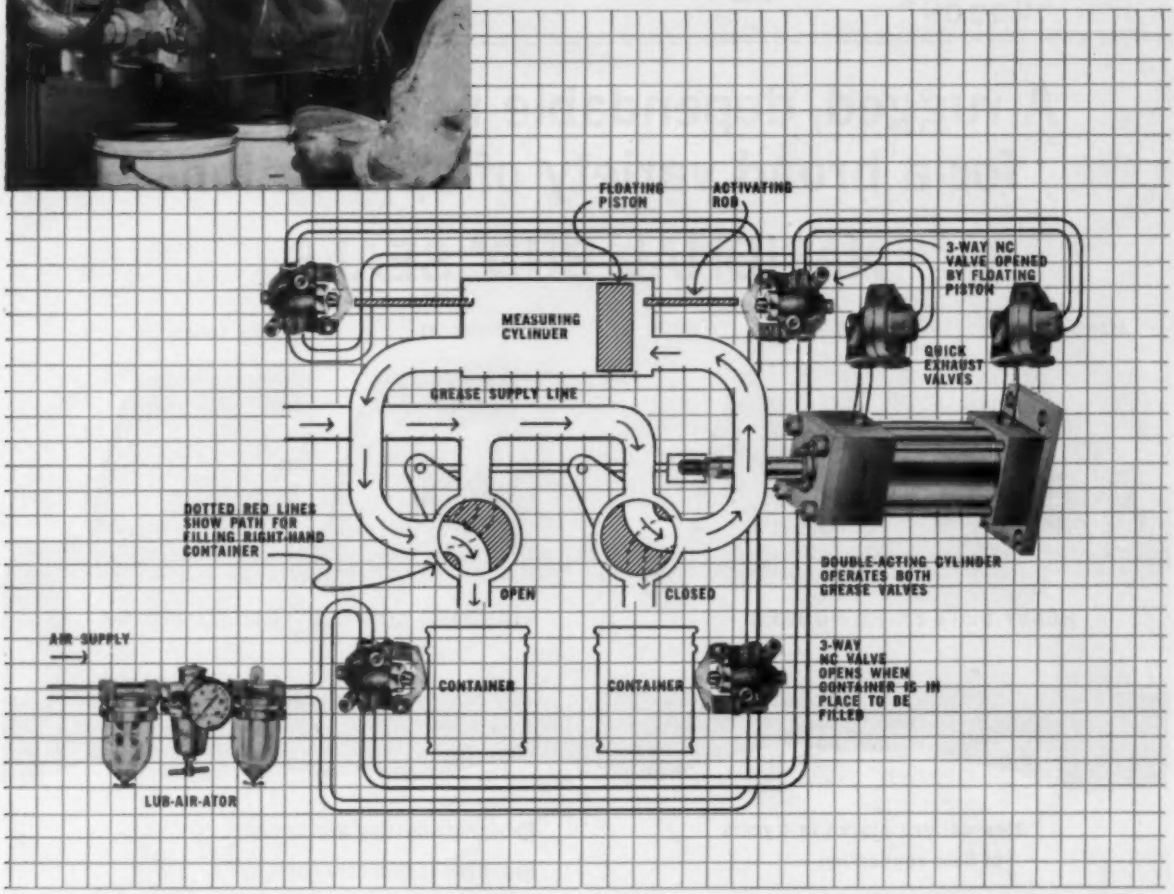


Here is an example of Schrader at work. Barrett Mfg. Co. of Houston, Texas, makes grease handling equipment for Mobil Oil's Brooklyn, N. Y., refinery. This machine fills 35 pound grease drums automatically accurately, 15 per minute! George Barrett, who designed and built this machine and other machines for Mobil, says: "My reputation for quality is too hard-won to risk by using some inferior line of air products."



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A rugged, dependable new shaft seal for a broad variety of applications

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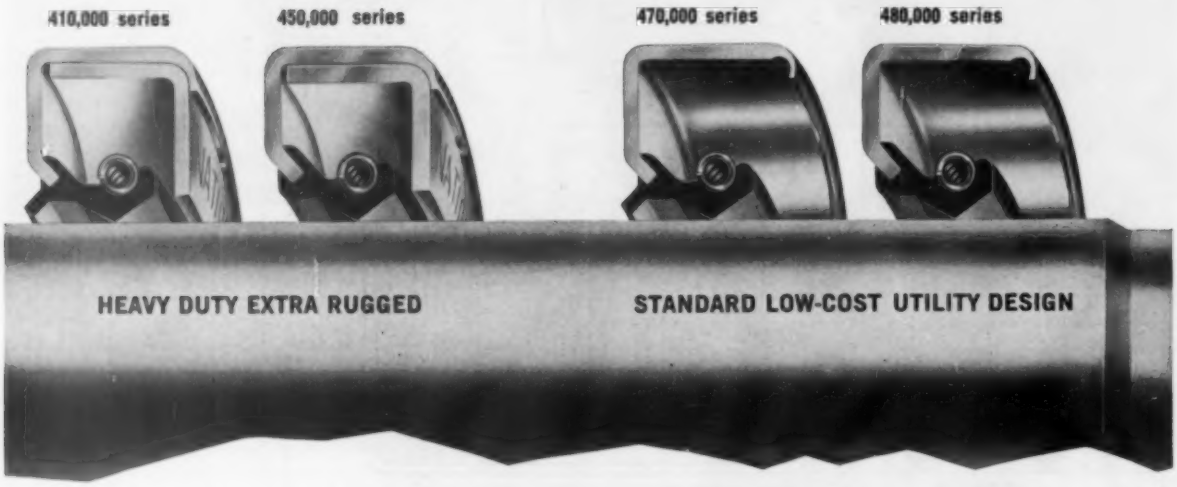

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FOR THE ENGINEER CONCERNED WITH DESIGNING SAFE, DURABLE, FLEXIBLE LINES

Written by engineers and well illustrated, this file contains a wealth of useful information on the application of swivel joints in line design. You'll find facts and figures on torque, geometric characteristics, thrust and radial loads. There's information on how to approach design problems and a quick comparison between swivel joints and other flexible devices. And, you'll find a group of actual installation reports with diagramatic drawings showing how the swivel joints were applied in the system. Be sure you have a copy of "Facts you should know about Swivel Joints" in your possession. Write Chiksan for your file today.

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USEFUL LITERATURE

For your free copy of publications reviewed, fill in the reader service card

HARDNESS CHART

Shows relationship of tensile strength and hardness of carbon and alloy steels. Hardness systems covered are Brinell, Monotron, Vickers, Rockwell (B, C & E scales), and Scleroscope. Technical Data Card 183. *Babcock & Wilcox Co., Beaver Falls, Pa.*

Circle **400** on Time-Saver Card

HEAT EXCHANGERS

Catalog binder has 102 pages on coolers, heaters, heat exchangers, and general data. Made up of 13 separate bulletins. 8½" x 11". *American Standard Industrial Div., Detroit, Michigan.*

Circle **401** on Time-Saver Card

FITTINGS

O-Ring fittings, JIC 37-deg, 2 or 3-piece flare tube fittings, SAE 2 or 3-piece straight thread flare

fittings, pipe fittings, valve fittings, tubing, and accessories. Each specification table has large, cutaway drawing. Completely illustrated index. 118 pages. *Lenz Co., Dayton, Ohio.*

Circle **402** on Time-Saver Card

MAGNETIC CARTRIDGE

Smooth-surfaced assembly can be wiped clean. Permanent Alnico V magnets arranged for optimum expansion of flux field. To clean, no need to drain reservoir or stop operations. Meets JIC. Two mounting-adaptor models have air breather to support ⅜"-dia cartridge. Others provide nonmagnetic flange combinations and pipe thread adaptors. 15 models, 4 mounting arrangements. *Kerns-Morrell Co., Detroit, Michigan.*

Circle **403** on Time-Saver Card

TEMPLATE FOR METAL RETAINED SEALS

Use drafting template to draw seal cross-sections. Pocket-size.

Made of semi-opaque, nonglare plastic. Cutouts duplicate pattern of Gask-O-Seals in twice and four times size. For four styles. Size printed in black above each style. Can be traced. Template has technical information, including dimensional and tolerance data. *Parker Seal Co., Div. Parker-Hannifin Corp., Culver City, Calif.*

Circle **404** on Time-Saver Card

SOLENOID VALVES

Packless valves are nondwelling, either fully closed or fully open. Solenoid may be taken from valve body without breaking electrical connections, while valve body remains in line. Bulletins 85-D to 103-D cover valves which handle wide range of fluids. Tables of power consumption, dimensions, pipe sizes, and weights. Operation and applications of each type explained. Drawings. Photos. Four pages of flow tables. 24 pages. *Magnatrol Valve Corp., Hawthorne, N. J.*

Circle **405** on Time-Saver Card

RELAYS

Manual features 30 types of relays with 1000 variations. Photos, line drawings, tables, descriptions. Outlines pile-up relays, variations in spring arrangement, timing, coil voltage, contact ratings. 40 pages. *Diaphlex Div., Cook Electric Co., Chicago, Illinois.*

Circle **406** on Time-Saver Card

HYDRAULIC POWER CHECK

Creates precise counterforce to cushion air or hydraulic cylinders. Operating cylinder forces hydraulic fluid through 1-way valve. Rate of flow governs cushion. Manually adjustable. May be furnished with air or solenoid-actuated pilot for stop or skip checking. Stainless steel or aluminum components. O-rings seal end caps. For strokes to 20", operating pressures to 3000 psi. *Appco Div., Pokorny Industrial Products Co., Cleveland, Ohio.*

Circle **407** on Time-Saver Card

AIR REGULATORS

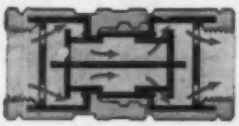
Kendall regulators are direct-acting, spring-actuated, bleed-type. Governaire regulators are piloted. Higher flow rates. Both for flow

or dead-end applications. Both have integral relief valves. Large, deeply-convoluted diaphragms. Catalog describes 25 regulators, volume boosters, and air relays. Lever-action type has short-stroke control lever for quick change of set pressure. Fitler-Dripwell unit for filtered, regulated air. Plunger model

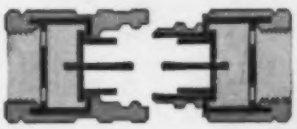
Continued on page 62

There's a size and type to handle almost anything that flows

TO USE SNAP-TITE VALVED COUPLING:



CONNECT—Full flow instantly



DISCONNECT—No flow instantly

Snap-Tite can provide the right size valved coupling for most any use . . . with quick off-on action wherever coupling or shut-off is required.

"H" series valved couplings for high pressure applications. High resistance to heavy line surge. Sizes from 1/8" through 6". Larger sizes on special order.

"IH" series valved couplings for greater impact in air lines. 1/8" through 1/2".

"E" series valved couplings for vacuum and very low pressure. Recommended for gravity flow. Sizes from 1/8" to 6". Larger sizes on special order.

"T" series valved couplings for hard to handle fluids. The only valved quick-disconnect couplings now on the market for fluid temperatures from −40°F to +400°F. Sizes from 1/2" through 3".

Snap-Tite valved couplings are available with two-way or one-way automatic line shut-off. They are normally furnished in alloy steel. Also available in brass, aluminum, or stainless steel with a variety of finishes.

Write for Snap-Tite Catalog No. 58 for more information on Snap-Tite valved couplings.

☆ Snap-tite
UNION CITY, PA.

97-59-68

USEFUL LITERATURE

for control by cams or mechanical linkages. Electric type has integral, reversible gear motor to drive adjusting screw. Specials available In boosters and relays, signal pressure functions as range spring in a pressure regualtor. Spring-biased boosters and relays. Air signal works with or against spring pressure. Catalog has circular slide rule for regulator selection. *Industrial Products Branch, Stratos, Div. Fairchild Engine & Airplane Corp., West Babylon, N. Y.*

Circle **408** on Time-Saver Card

CYLINDER TEMPLATES

Full-size tracing templates of small air and oil cylinders. Templates slip under tracing vellum. Accurate to pencil-line width. Cylinders for 200-psi air or 750-psi oil, and 2000-psi oil. Capacity chart has push and pull forces at various pressures. Bores ¾", 1", and 1⅛". Two Block Vee packings on piston, one on rod. Stainless steel rods have ⅜" diameter. Rod diameter reduced on end. Thread will not cut packing lip. Neoprene gaskets for medium-pressure end-cover seals. Buna N O-rings for high pressure. Chart has maximum recommended strokes. Double-acting cylinders in ten mountings. Spring-return cylinders on special order. Folder has price list and weight chart. *Control Line Equipment, Cleveland, Ohio.*

Circle **409** on Time-Saver Card

CENTER-NEUTRAL LIMIT SWITCH

Replaces two limit switches. Saves wiring and installation costs. Assembly is oil-tight when properly connected to sealed conduit. ¾" NPT fitting for conduit. O-rings at actuator shaft and actuator head-to-housing joint. Gasket between switch housing and terminal block. Plug-in feature—Mounting block remains wired and mounted on machine. Roller-lever actuator operates one basic switch when moved left; the other, when moved right. Electrical rating for each basic switch: 10 amp at 120, 240, 460 vac; 0.8 amp at 115 vdc; 0.4 amp at 230 vdc; 0.1 amp at 550 vdc. Operating force is 3 lb. max; full overtravel force, 4 lb. max.; release force, ½ lb. max. Pretravel is 15 deg. max.; differential travel, 10 deg. max.; overtravel, 30 deg. min.; release travel, 5 deg. min. Data sheet 168 has photos and dimension drawings. Shows operating details. *Micro Switch Div., Minneapolis-Honeywell Regulator Co., Freeport, Illinois.*

Circle **410** on Time-Saver Card

HOSE & COUPLINGS

Hytron hose has seamless, extruded inner tube of virgin polyamide. High-strength polyester braid reinforcement. Extruded polyamide cover is fluted for torsional strength. Burst pressure is 9000 to 12,000 psi. Lower OD to ID ratio than rubber hose. Hose life to 7 times greater than that of wire-braided rubber hose. For —40 to 225 F continuous, 250 F intermittent. No restriction of ID with age. No need to compensate for swelling from solvent adsorption. Engineering data on flex-impulse capacity, flexibility, abrasion life, torsional fatigue. Chart of chemical resistance. Section on theory of fluid flow in hose. Flow nomograph. Installation tips. Release NEPR-500 shows reusable couplings. Male and female flare connectors, flare swivels, bent tubes, male pipe thread. Assembly instructions. Shows assembly machine and hose cutter. *Imperial Brass Mfg. Co., Chicago, Illinois*

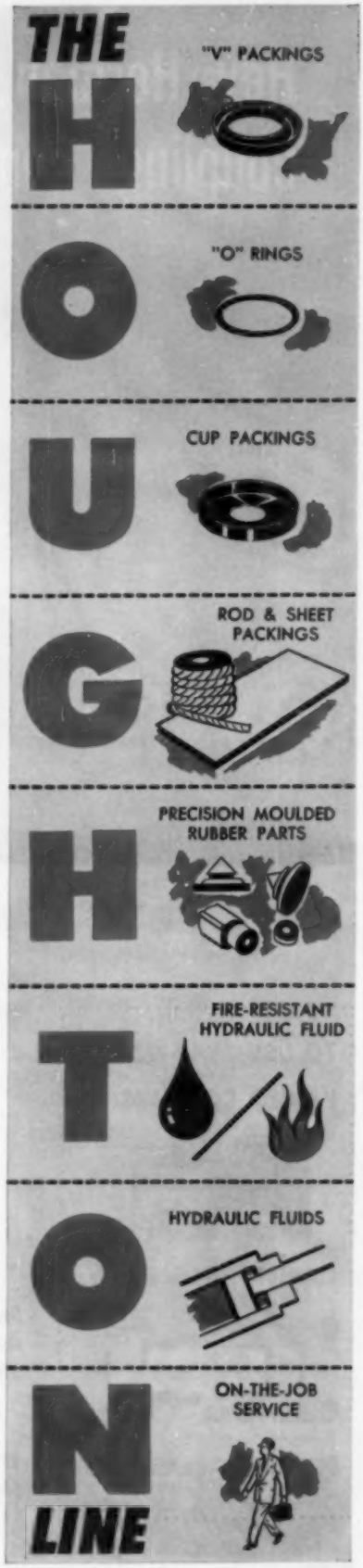
Circle **411** on Time-Saver Card

AC MAGNETIC STARTERS

Arc quenching principle controls and quickly extinguishes arc which occurs when contacts open under load. Longer contact life. Two multi-turn magnetic blowouts with twin-break contacts on each pole. Each arc chamber is enclosed in steel shell. No carbonizing, because all parts within arc chamber are metal. All parts readily removed from front. Sizes 0 to 4. Bulletin PL 12-8-160 explains arc quenching principle. Shows combination starters. Photos show ease of maintenance. 8 pages. *Clark Controller Co., Cleveland, Ohio.*

Circle **412** on Time-Saver Card

For more reviews of FREE LITERATURE turn to page 142



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the
NEW HOUGHTON PACKING

made of a
NEW HOUGHTON COMPOUND

sets
NEW PERFORMANCE STANDARDS

Houghton's new Rex-Syn cup packings are made from a unique compound of resin blended with synthetic rubber to provide a tough, strong, yet pliable cup packing for good sealing and easy installation.

1. **Low Friction** — Rex-Syn cup packings have a low friction rating—"equal to the best on the market!"

2. **High Abrasion Resistance** — Rex-Syn cup packings showed only slight wear after (a) 324,000 cycles at 4,000 psi; and (b) after 500,000 cycles at 100 psi.

3. **Wide pH Range**—Rex-Syn cup packings resist chemical attack over an unusually wide range of alkalies and acids—from pH-0 to pH-11.8!

4. **Wide Range of Use**—Rex-Syn cup packings can be used with air, oil, water and water-oil emulsion and water-glycol fire-resistant fluids.

5. **Wide Temperature Range** — Rex-Syn cup packings will withstand temperatures from 0°F. to 212°F.!

6. **High Tensile Strength** — Rex-Syn cup packings are moulded of a new compound rated at 3290 psi, an above-average figure for general use!

7. **Low Extrusion**—Rex-Syn cup packings have been tested up to 6,000 psi with very little evidence of extrusion (cold flow).

8. **Low Cost**—Rex-Syn cup packings are economical—cost less than fabricated packings in most sizes!

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B&W *Job-Matched Lectrosonic hydraulic line tubing*

B&W offers you:

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- a hydraulic line tube that costs far less than seamless in comparable sizes

B&W Job-Matched LECTROSONIC Hydraulic Line Tubing is available through a nationwide network of district sales offices and steel service centers. And remember — matching tubes to jobs assures you the *right tube,* in the *right quantity,* at the *right time.* For more information, call your local B&W District Sales Office, or write for Bulletin T-435. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pennsylvania.

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TUBULAR PRODUCTS DIVISION

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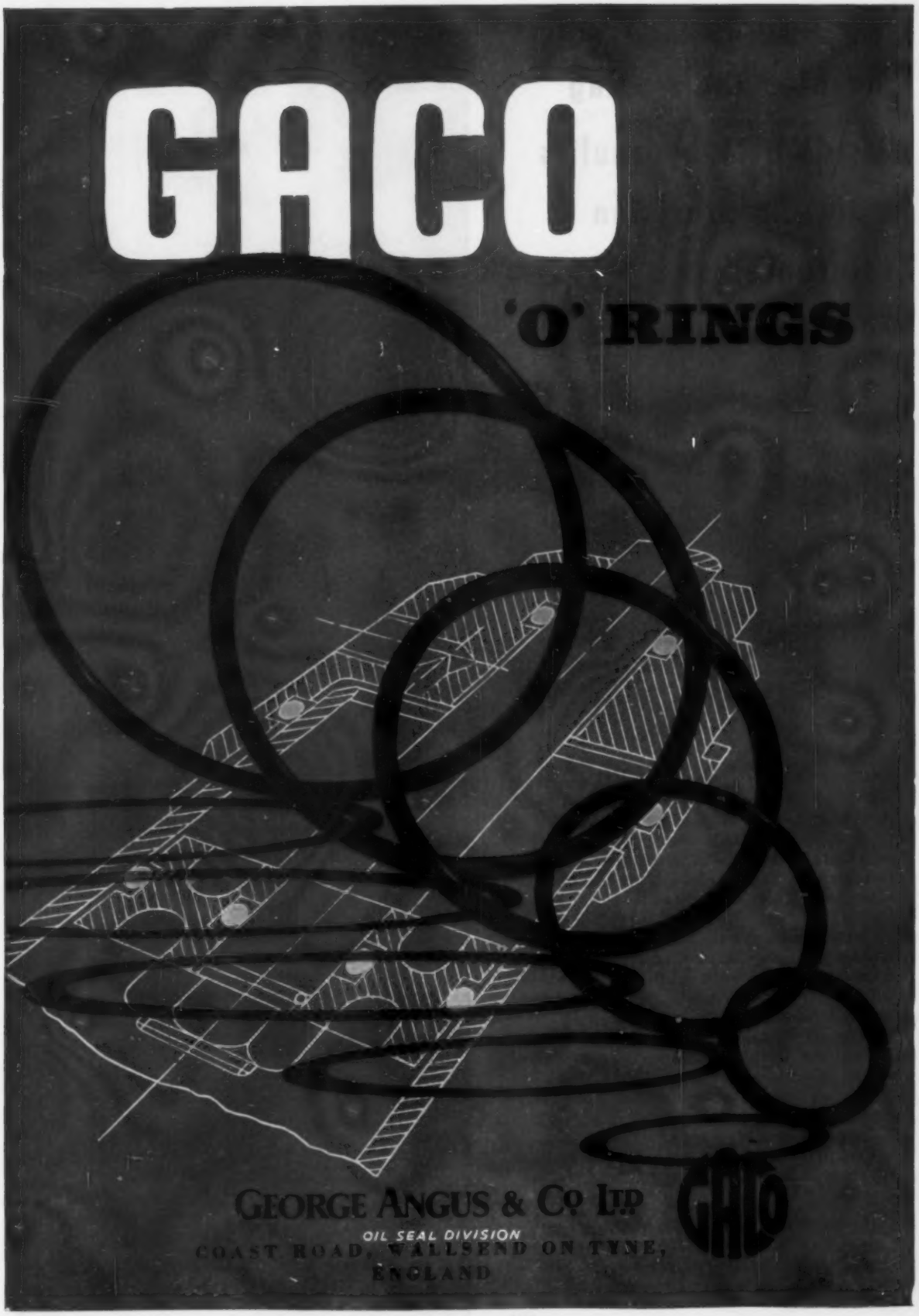
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GEORGE ANGUS & Co LTD
OIL SEAL DIVISION
COAST ROAD, WALLSEND ON TYNE,
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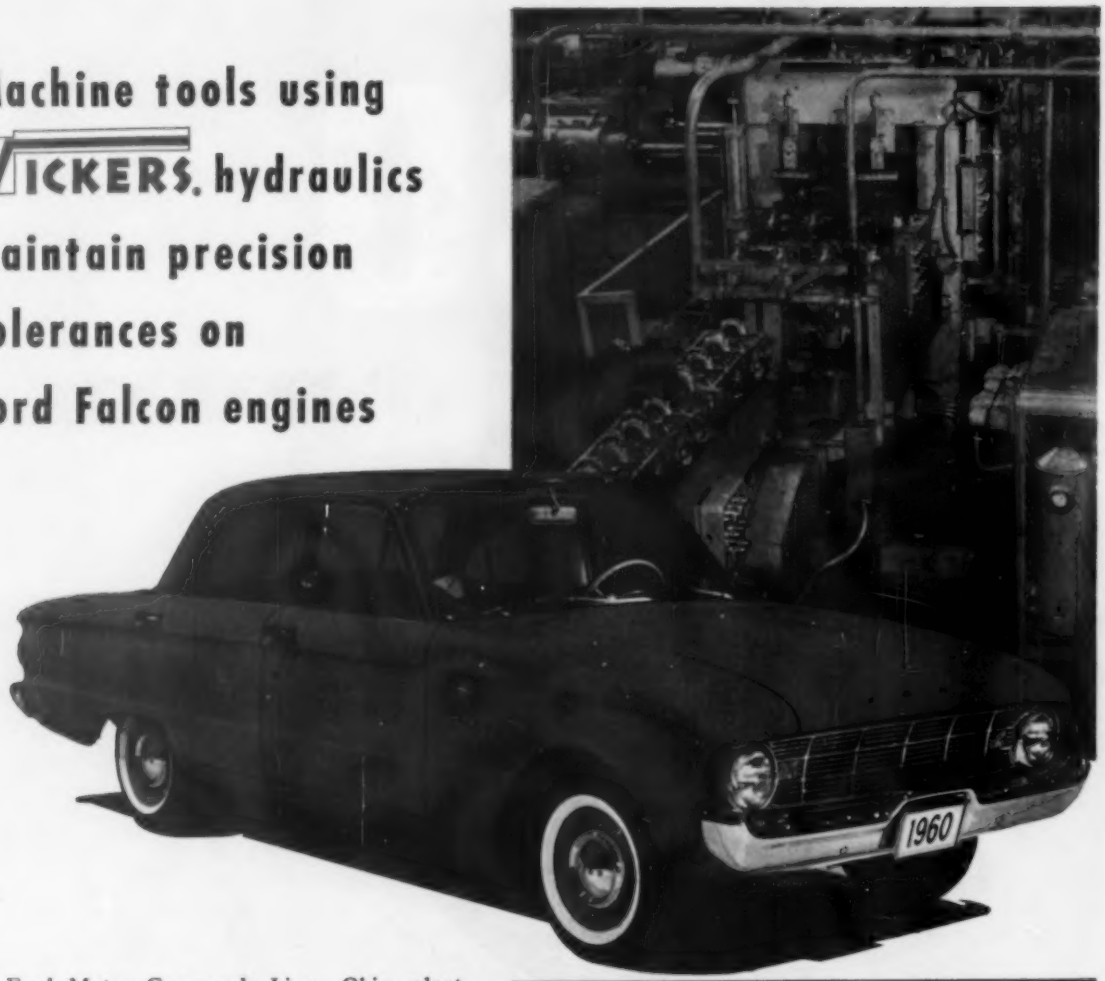
Machine tools using VICKERS hydraulics maintain precision tolerances on Ford Falcon engines



At Ford Motor Company's Lima, Ohio, plant you'll find the newest techniques and finest equipment being used to produce the six-cylinder, high efficiency, overhead valve engine developed specifically for the new Falcon. And, coincidentally, you'll find many of the machine tool builders have equipped their modern machines with Vickers hydraulics.

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You get "extra" planning help from sales engineers who are hydraulic specialists responsible for the products of a single manufacturer. Skilled technicians who are always near at hand assure better service, too.

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Machinery Hydraulics Division
DETROIT 32, MICHIGAN

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Machine tool builders using Vickers components at the Falcon engine plant

Apex Corporation
Bilt-Rite Tool Co.
Buhr Machine Tool Co.
Con-Tec Division Centri-Spray Corp.
Colonial Broach & Machine Co.
The Cross Co.
Ex-Cell-O Corporation
Greenlee Bros. & Co.
Hulcraft & Company
Industrial Metal Products Corp.
The Ingersoll Milling Mach. Co.
Kent-Owens Machine Company
H. R. Krueger & Co.
F. Jos. Lamb Co.
Landis Tool Company
LaSalle Machine Tool, Inc.
The R. K. LeBlond Mach. Tool Co.
Leland Detroit Mfg. Co.
Micromatic Hone Corporation
Morris Machine Tool Co.
The Natch & Morryweather Machine Co.
Snyder Corp.
Sundstrand Machine Tool Division of Sundstrand Corp.
Surface Combustion Division of Midland-Ross Corp.
Tocco Division The Ohio Crankshaft Co.
Turner Brothers
Wilson Automation Co.

Hydraulics & Pneumatics

JULY 1960

Prevent pressure drop with circuit isolation

ROTATING BORING HEAD bores axle holes in railroad car wheels. After wheels are clamped to the fixture slide, they move forward together for machining.

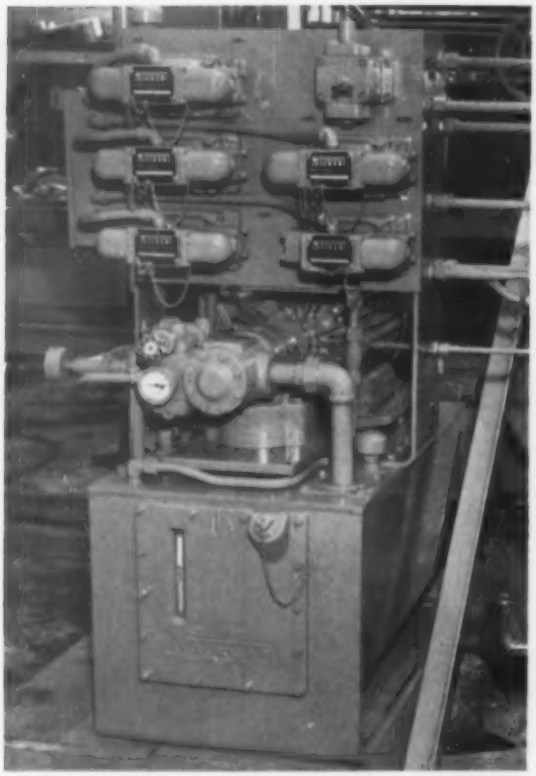
• By **JOHN R. FINLEY,** *Hydraulic Engineer, Special Machinery Div., Kearney & Trecker Corp., Milwaukee, Wis.*

This article was awarded Honorable Mention in the 1959 HYDRAULICS & PNEUMATICS *Prize Paper Contest*

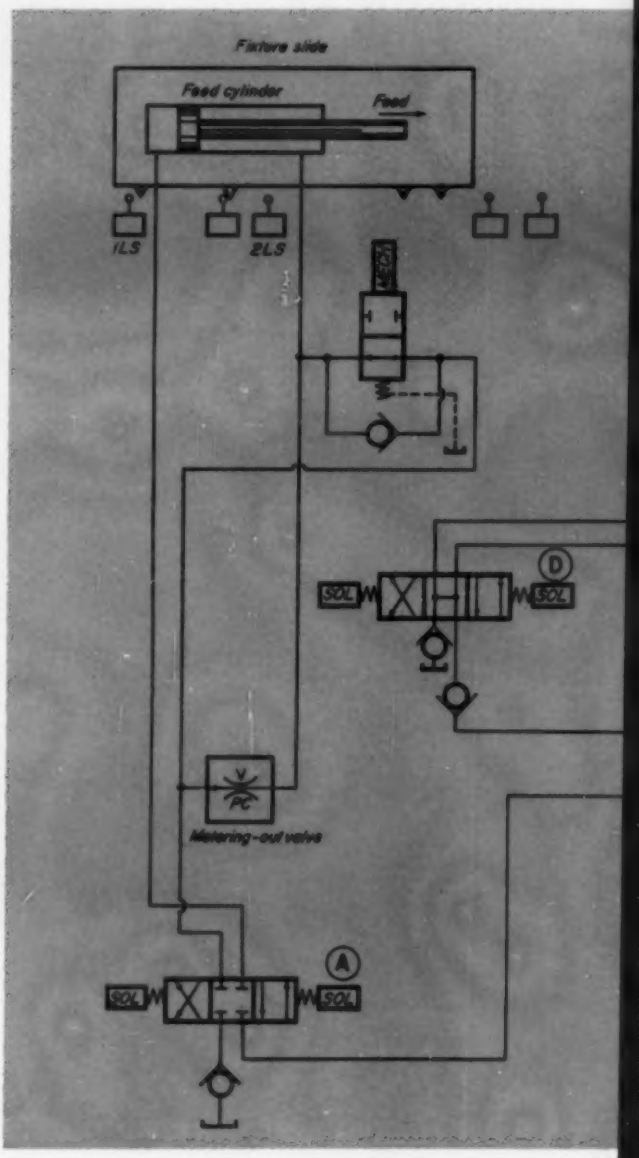
HERE is a convenient way to get the speed of a two-volume (hi-lo) combination pump plus the advantages of two single pumps. One of the inherent faults of a hydraulically-operated machine is that pressure in the whole system drops when any single cylinder moves. This is especially undesirable when clamping or feeding.

This circuit features an interconnecting valve which is a solenoid-operated, 2-way valve. It allows both pump volumes to provide a rapid machine motion when necessary, or else lets the pumps operate individually. Cylinder motion or unloading of one pump has no affect on operating pressure of the other pump.

This design has been successfully applied to a series of 3-station, transfer-type machines which bore out axle holes in railroad car wheels. The machine



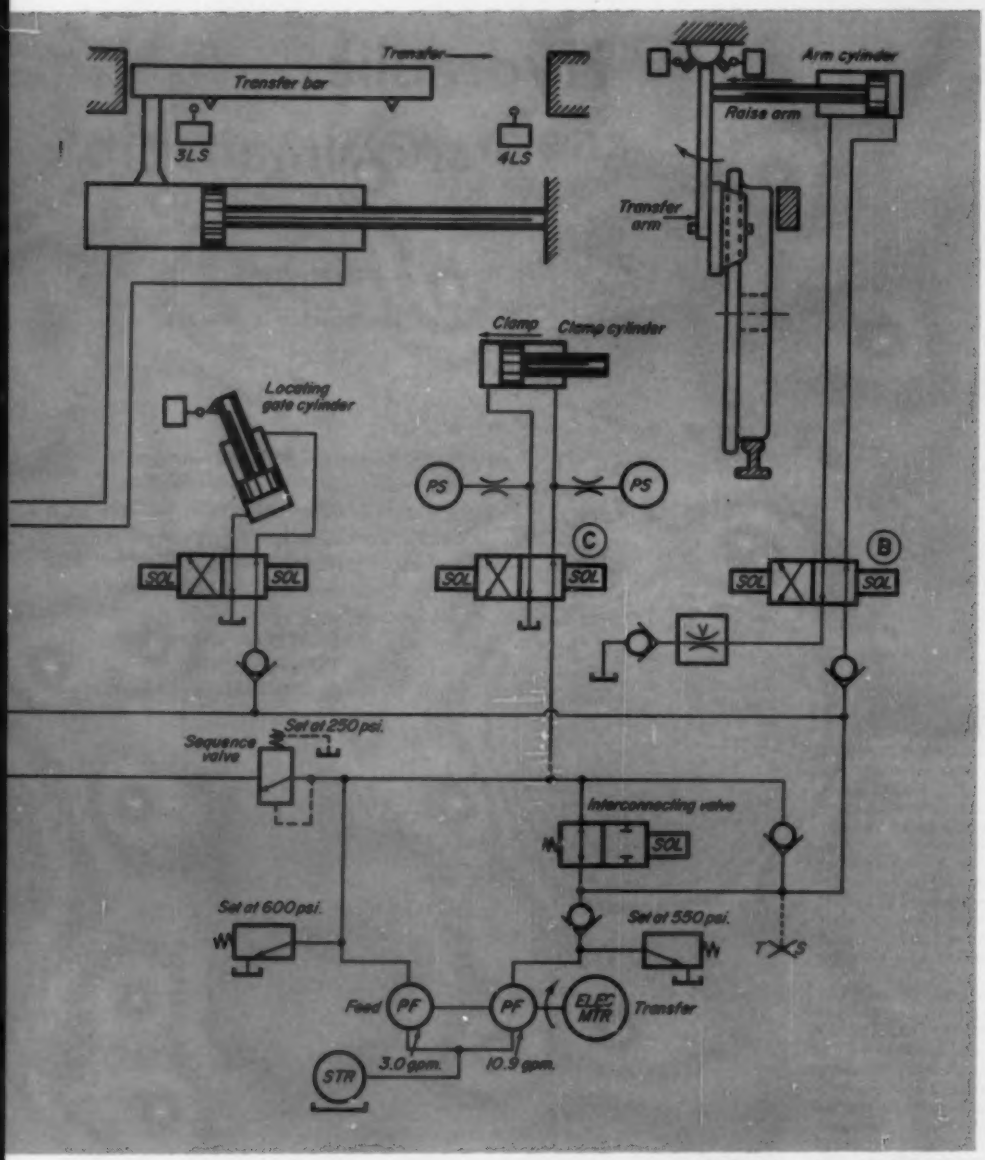
FIVE DIRECTIONAL CONTROL VALVES and a sequence valve are panel mounted together on the tank for easy maintenance and checking. Drain lines are connected to a vented manifold.



bores 68 wheels an hour. Handling has been greatly improved over previous machines.

• **Arms Grip Three Wheels**—When the machine cycle begins, three wheels are transferred to the next position by transfer arms equipped with rollers. At this time solenoid *D* of the transfer valve is energized, with the INTERCONNECTING valve de-energized. The volumes of both pumps are available for the rapid motion of the transfer bar. At the end of the transfer stroke, 4*LS* is contacted and the feed valve's solenoid *A* is energized. The chuck, which is mounted on a movable slide, is brought forward rapidly into position to clamp the wheel. Here again, both pump volumes provide a rapid motion to the slide. When the fixture slide is in position it is decelerated and stopped when 2*LS* is depressed. The wheel is then chucked in the fixture as solenoid *C* of the CLAMPING valve is energized. Pressure switch *PS*-1 is actuated when clamping is completed and then solenoid *B* of the ARMS valve is energized to raise the transfer arms. When the transfer bar returns, 3*LS* is contacted and the INTERCONNECTING valve is then energized. The system is then separated into two independent circuits. At this time the feed cylinder moves the fixture forward again.

• **Stationary Boring Head**—The chuck carrying the clamped wheel feeds toward the spindle at a set feed rate. The 125-hp boring head is mounted on the



ENERGIZED INTERCONNECTING VALVE separates the system into two circuits, each with its own pump. The transfer pump delivers to the transfer arm, locating gate, and transfer cylinders. Their movement does not disturb the feed and clamp cylinders whose delivery is maintained by the feed pump. When the interconnecting valve is de-energized, the system becomes one circuit again. The feed pump's delivery speeds the various transfer cylinders. The transfer pump speeds the return of the fixture slide and unclamping.

base of the machine. During feeding the transfer bar is reset to its initial position, and the transfer pump is unloaded to tank through the open-center transfer valve.

Regardless of pressure fluctuations in the transfer circuit, there will be constant pressure in the clamp and feed circuits. The sequence valve holds pressure on the clamp during rapid transverse of the feed cylinder.

When the operator loads a new wheel at the loading station against a locating gate, the transfer arms lower into the transfer position and then the locating gate retracts.

When machining is completed, the interconnecting valve is de-energized. The wheel and fixture rapidly return to the intermediate position in the transfer line. The chuck unclamps and the wheel rests on the transfer rail. The fixture slide then returns to its initial position and the machine is now clear for another transfer stroke. When *1LS* is contacted, all solenoids are de-energized and both pumps unload through the transfer valve. ▼▼▼

Hydraulic showmanship

● By **ROBERT LUSTIG**, *Hydro-Craft Inc.*

and **DONALD J. ARNOLD**, *Denison*

GENERAL MOTORS premiered its '59 autos in a theatrical extravaganza at New York's Waldorf-Astoria. Back of the gala production numbers which featured dancers and cars which swept across the stage together, was an extensive hydraulic system. Worked out by Hydro-Craft, Inc., the system lifted and rotated cars, swept them downstage, and operated disappearing floors. Special problems? There were plenty. Power packages (three of them) had to roll on wheels. All lines had to be flexible hose with quick

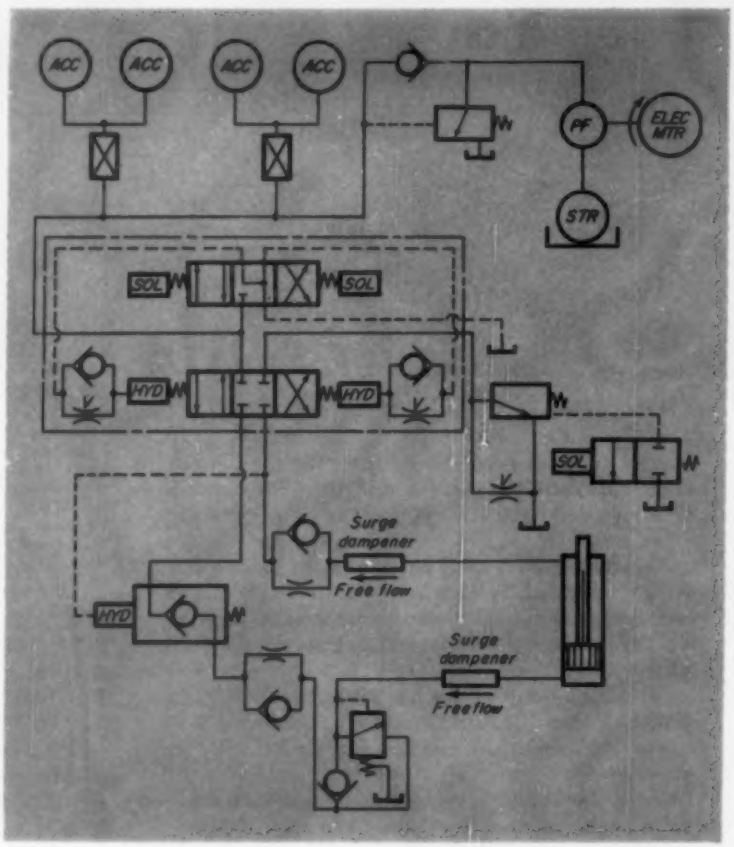
THIS SYSTEM RAISES AND LOWERS a car on each side of the stage. To accelerate and decelerate the cylinder smoothly at each end of its stroke, the directional valve's tank line is connected through a pilot-operated relief valve and flow control valve in parallel. The relief valve's vent line is connected through a solenoid-operated, 2-way valve which starts deceleration. The solenoid valve is energized during the cylinder's up and down travel, so that the relief valve's vent line is connected to tank and the valve offers no resistance to flow. The solenoid valve is de-energized to start deceleration. The relief valve then requires an opening pressure corresponding to its spring setting, and it limits the initial pressure surge caused by restricting the tank line.

During deceleration, the cylinder acts like a pump forcing flow first through the relief valve and flow control valve, then through the flow control when the relief closes. Flow through these orifices dissipates kinetic energy of the cylinder as flow to the cylinder is closed off at the directional valve. When all energy has been used up, the cylinder stops. Reverse action causes smooth acceleration of the piston. The 4-way valve is shifted while the cylinder rod is on the limit switch holding the relief valve closed. The flow control makes the piston leave the limit switch slowly. The relief valve then opens and the piston goes to full speed.

This valving arrangement requires only one limit switch at each end of the cylinder stroke to actuate the 2-way valve. Deceleration distance is easily adjustable with the flow control valve.

Surge dampers in both cylinder lines insure smooth operation. The one in the rod-end line compensates for accumulator effect of the long flexible hoses used in this system. The one in the head end line prevents jump when starting up from mid-stroke after some oil has drained from the line.

In addition to a counterbalance valve which helps give smooth cylinder action, a pilot-operated check valve is connected in the cylinder line as a safety. It prevents the cylinder from drifting down except when pressure is applied to its rod end to force it down.



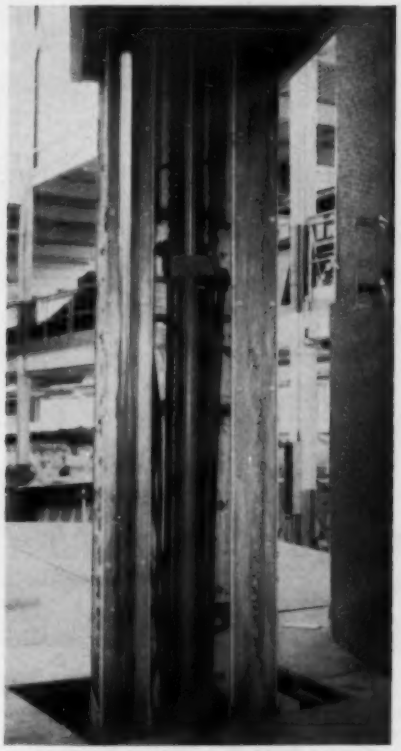
yields design ideas

Detroit, Michigan

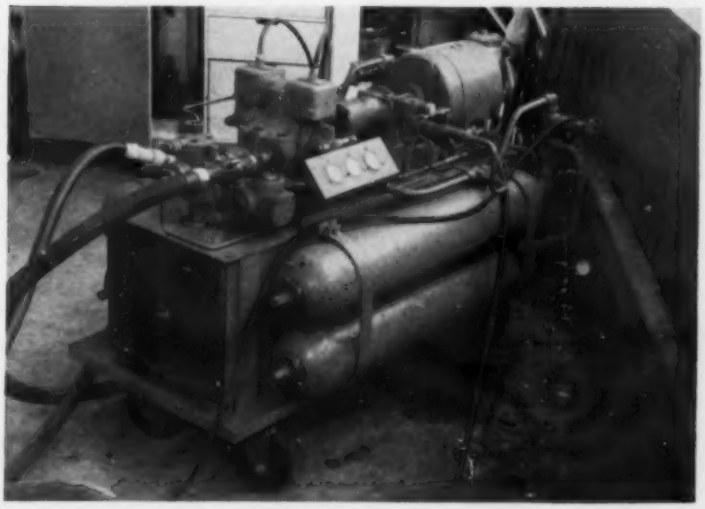
Engineering Div., American Brake Shoe Co., Columbus, Ohio

disconnects, so the equipment could be set up quickly in the hotel's third floor auditorium.

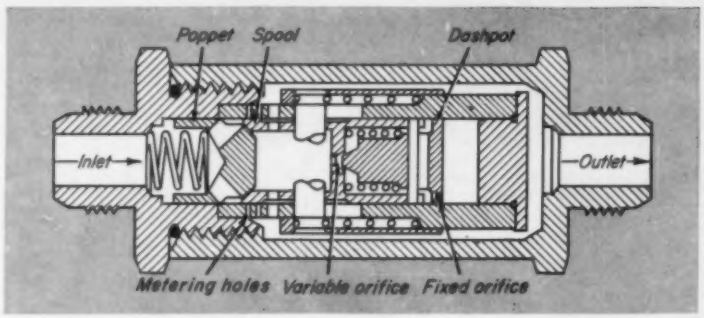
Accumulators were used extensively to cut pump operation, and power consumption through the non-industrial, electrical distribution system. Less pump operation meant less noise to interfere with the show's music. To reduce pump operation even further, unloading valves were modified for a 12% differential; that is difference between opening pressure and closing pressure is 12% of full open pressure. The valves normally have a 10% differential which gives a closer control of system pressure but more frequent pump cycling. ▼▼▼



FIVE-INCH CYLINDERS hidden in the side posts lift cars as the music swells. Their 72-in. stroke is increased through a chain drive similar to a fork lift truck. Up and down strokes are each timed at six seconds.



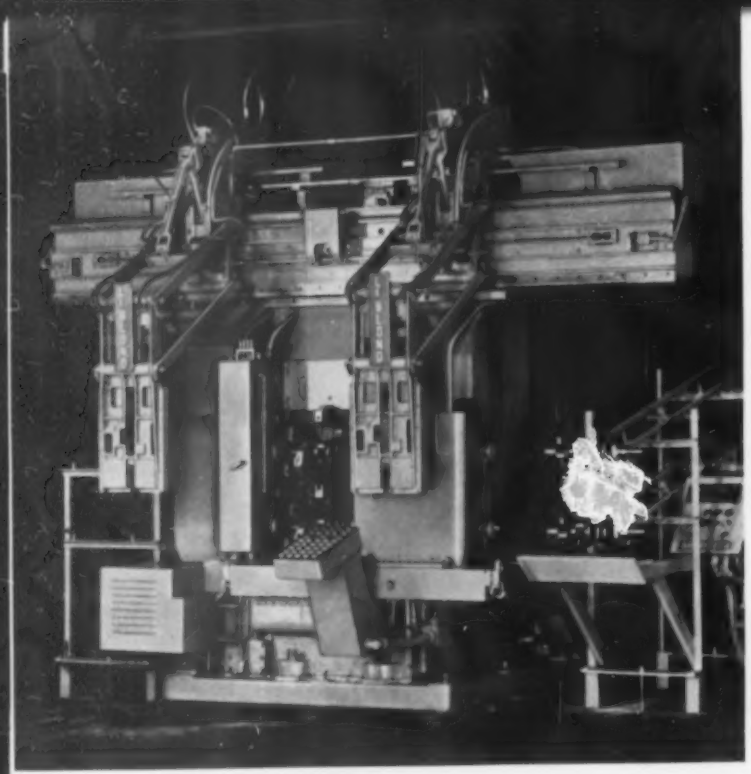
MOUNTED ON WHEELS, this power unit has a 5-hp axial piston pump, four 10-gal accumulators, and control valving. The reservoir is of non-welded construction, having a one-piece tank closed at each end by covers which bolt to a center baffle, and seal with the tank. The reservoir is supported on four legs, so that the tank itself does not have to hold up components mounted on it.



SURGE DAMPING VALVE used in circuit at left is normally closed, opens when pressure is applied to the inlet. It allows a gradually increasing flow until fully open. When flow is interrupted, the valve closes.

Impulse flow at the inlet forces the poppet and spool at the right. This uncovers holes in a sleeve and allows flow through holes in the poppet and sleeve to the outlet port. The spool's speed is limited as it pushes the dashpot to the right, metering fluid through the fixed orifice from right to left, and through the variable orifice.

The valve opens slower at high pressures than at low pressures. Its opening rate increases as pressure in the outlet line approaches inlet pressure. *Courtesy Denison Engineering Div., American Brake Shoe Co.*

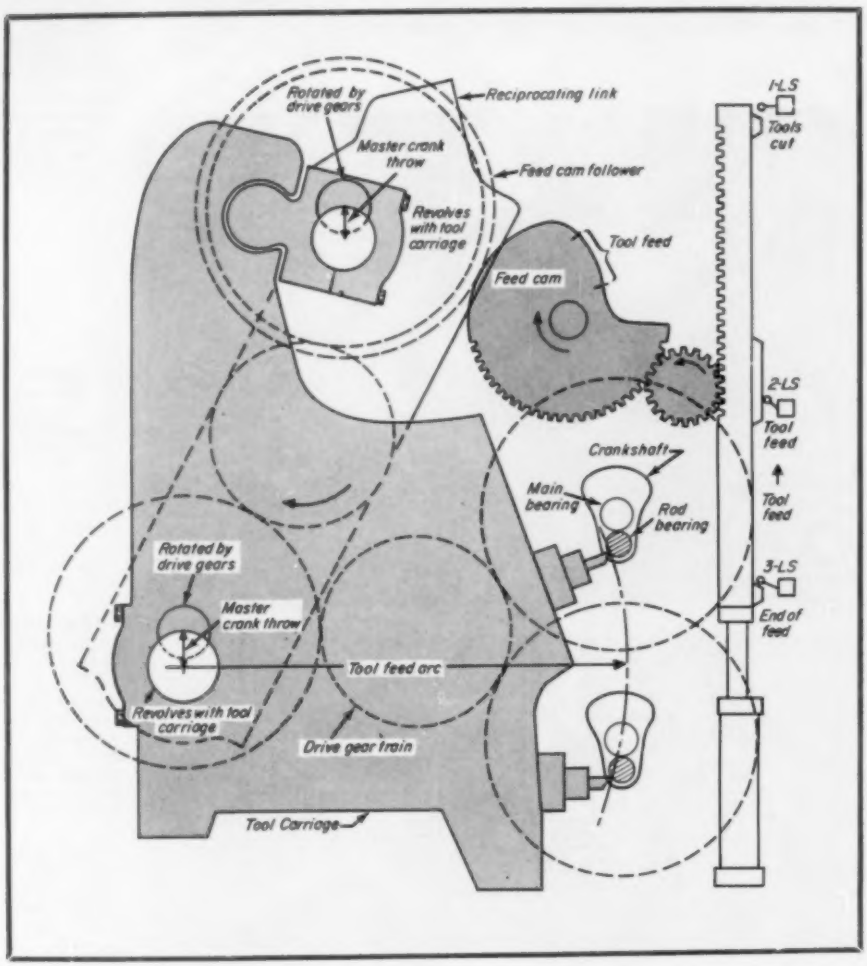


CRANKSHAFT LATHE machines connecting rod bearings on automotive crankshafts. A tool feed cam is rotated by a pinion gear driven by a cylinder-powered rack.

Fine tool feed

• By **GEORGE RUEHRWEIN,** *The R. K. LeBlond*

A cylinder-actuated cam gives the speed control that's needed to machine crank shafts. Tool feed must be fast to face the sides of the counterweights. Fine, accurate feed is needed to turn the connecting rod bearings. Cylinder speed is easily adjusted to control these speeds.



GEARS ROTATE THE TOOL CARRIAGE through an arc determined by the master crank throw. The master cranks have the same throw as the crankshafts being machined. All rotate at the same speed.

Tool positions are shown at the end of the feed stroke, before the cylinder retracts. The tools feed up into the work. High point on the cam determines depth of cut. When the cylinder retracts, the tools drop down for unloading.

A cam on the rack actuates limit switch 2-LS which starts slow speed. Another cam on the feed rack actuates 3-LS at the end of tool feed. This opens the bypass around the flow control valve and the rack extends rapidly until 1-LS shifts the control valve and retracts the cylinder.

for crankshaft machining

Machine Tool Co., Cincinnati, Ohio

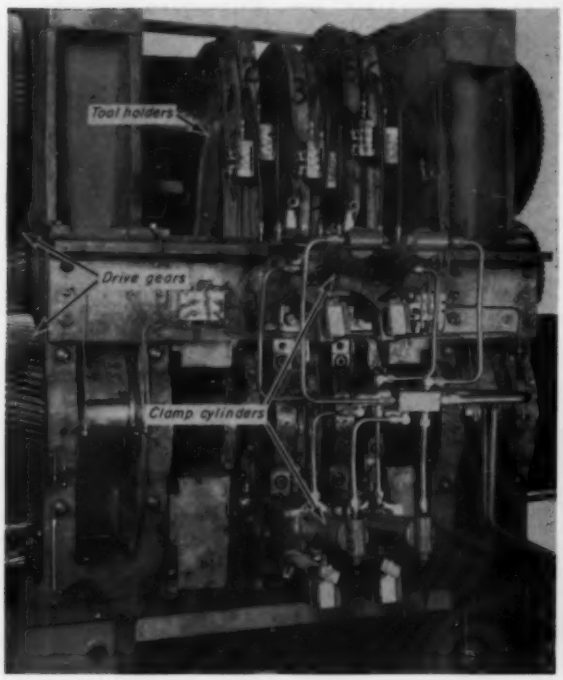
HOW do you machine a surface that's revolving while rotating in a circular orbit like a satellite? Designers of this crankshaft lathe have the answer. Cutting tools follow the crankshaft rod journals around their orbit. To get the feed required, a cylinder rotates a cam through a rack and pinion to feed the tools.

The lathe machines two crankshafts simultaneously. They revolve at the same speed and are driven and synchronized by gears. The same gear train that revolves the crankshafts also moves the tools so that they follow the orbit of the crankshaft rod bearings.

The tool carriage mounts on two master crank bearings having the same throw as the crankshafts being machined. A cam moves the top bearing in and out to feed the tools. A pinion, driven by the cylinder rack rotates the cam. As the cylinder extends and retracts, the cam moves the tools in and out.

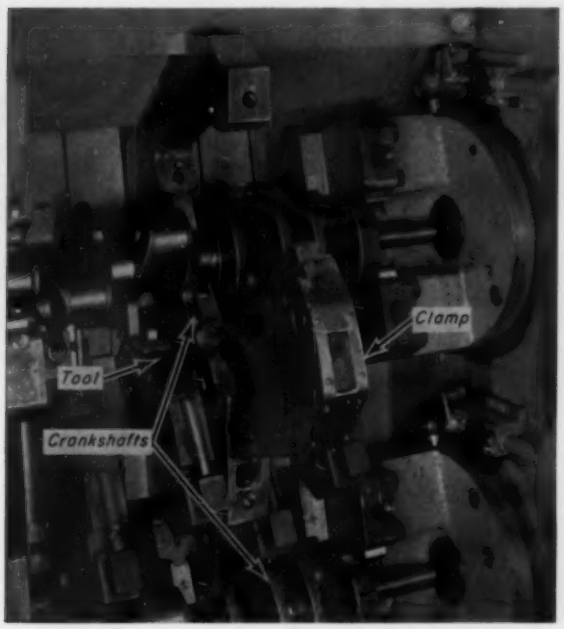
The feed cylinder extends fast for facing the sides of the counterweights until a limit switch shifts a 2-way solenoid valve. The valve closes and forces cylinder exhaust through a flow control valve. This slow feed is for machining the bearing surfaces. Tool feed is adjusted by setting the flow control valve.

▼▼▼



CHUCKS GRIP THE CRANKSHAFTS and rotate them about the main bearings. Large gears drive and synchronize movement of the crankshafts and tool carriage.

TWO CRANKSHAFTS IN PLACE for machining. The chucks are closed by hand and a hydraulic cylinder mounted in the rear of the machine pulls them up tight. The machining tools mount on a carriage that is moved up to the work by a cylinder-driven cam.



How to design sequencing air circuits

• By F. X. KAY, *Technical Manager, Martonair Ltd., Richmond, England*

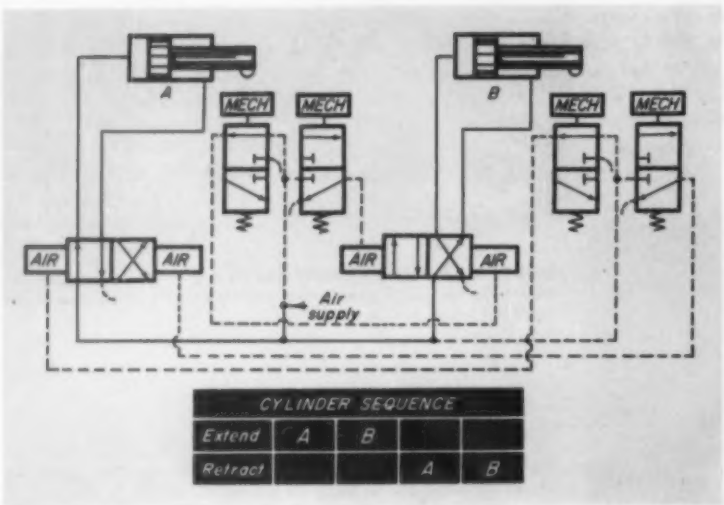


FIG. 1. SPRING-RETURN, 3-WAY PILOT VALVES initiate movements in sequence in this two-cylinder circuit.

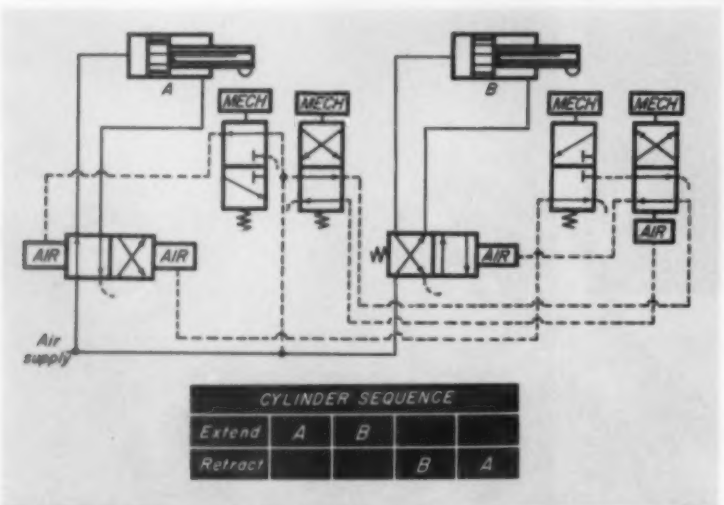


FIG. 2. A DETENTED, MECHANICAL-PILOT VALVE allows cylinder B to retract while cylinder A remains extended. Cylinder B retracting shifts control valve to retract cylinder A.

THERE are two methods for sequencing air circuits. One uses limit switches to actuate solenoid control valves. This method is positive but requires an electrical circuit. Also the cost of solenoid valves and limit switches, and their wiring time is often an important factor in the overall cost of the system.

An often simpler, and less costly method of controlling circuits uses pilot air valves actuated by cams attached to cylinder piston rods. The pilot valves direct air to and from actuators on the cylinders' control valves.

There are two types of pilot valve signals in an interacting circuit. One is an impulse at either end of the stroke that is removed when the cylinder reverses. The other is a full cycle impulse where the pilot valve stays in its actuated position after the cylinder retracts. This needs a valve which is cam-actuated to one position and air actuated to the other position. Once actuated, it remains in that position until shifted by the other actuator. This type of detented valve is required when one cylinder extends and retracts while other cylinders in the circuit remain extended.

The first step in laying out a sequencing circuit is to letter the cylinders and list them in the order in which they move. A horizontal table can be used for less complicated circuits. However, in a more complex circuit or where two or more cylinders extend together a vertical table is more satisfactory.

The next step is to draw the cylinders and locate a 2-poistion pilot valve at each end of the cylinders' stroke. The pilot valves should be drawn with mechanical actuators at one end. The other actuator will vary depending on the sequence. The main control valves should

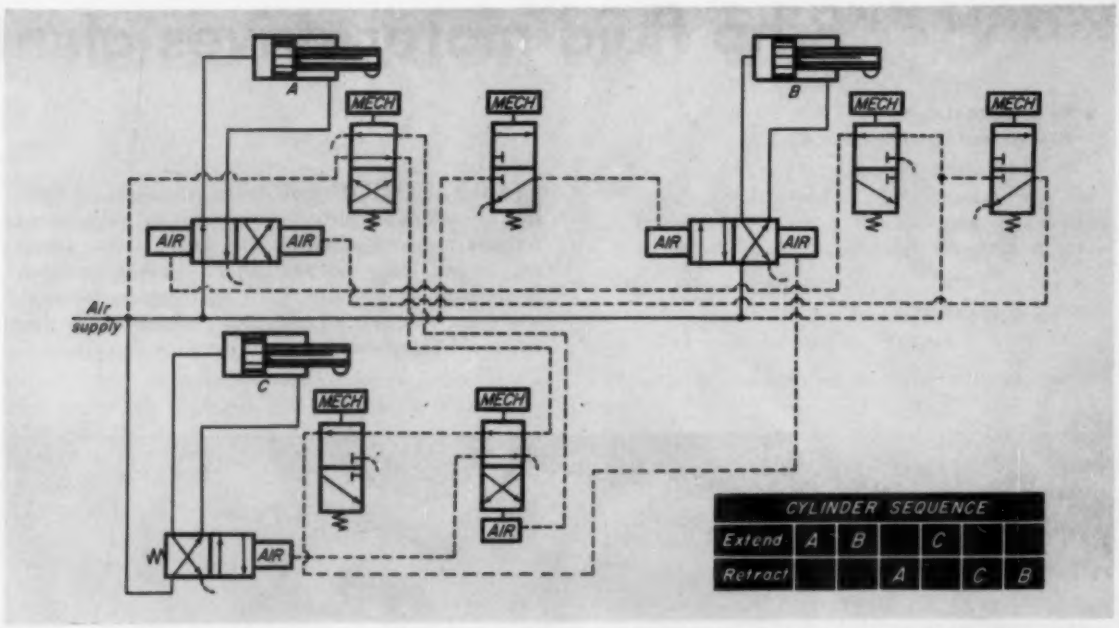


FIG. 3. CYLINDER C ACTUATES a detented, mechanical-pilot valve when it extends. This valve has two functions. It drains the air from cylinder C's control valve pilot, causing the spring to shift the valve and retract the cylinder. It also applies air to the pilot valve actuated when cylinder C retracts. This prevents cylinder A from retracting until cylinder C extends and retracts.

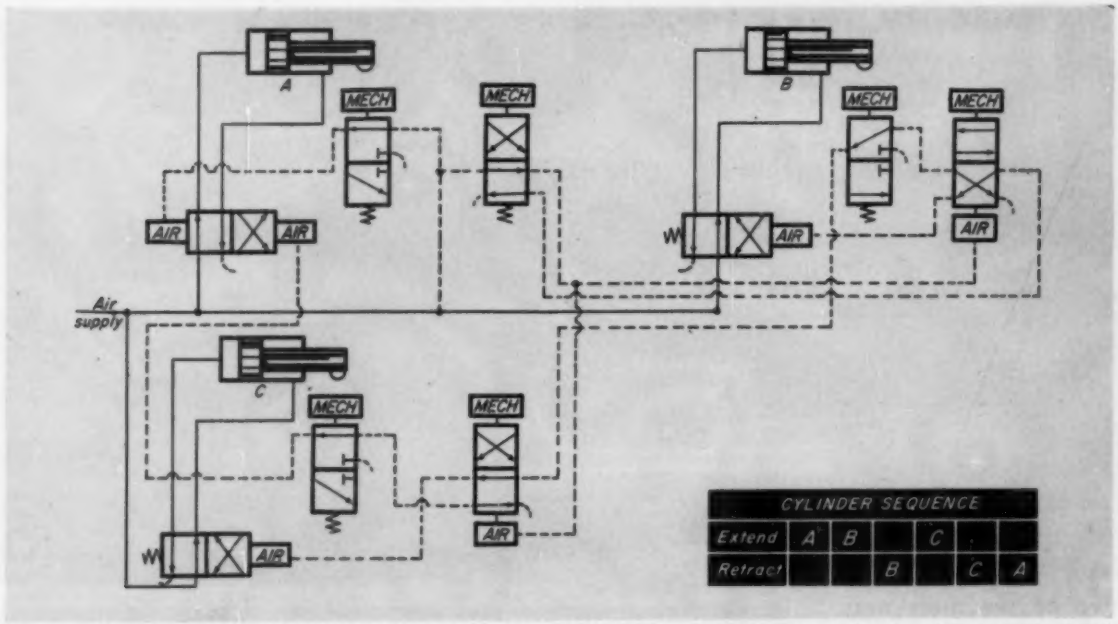


FIG. 4. TWO DETENTED, MECHANICAL-PILOT VALVES are needed in this circuit because cylinders B and C must extend and retract before cylinder A retracts.

be drawn with air pilots at both ends, if the cylinder they control does not extend and retract in sequence. If the cylinder extending initiates its own retraction while the initiating signal remains, a spring return, air pilot control valve is used.

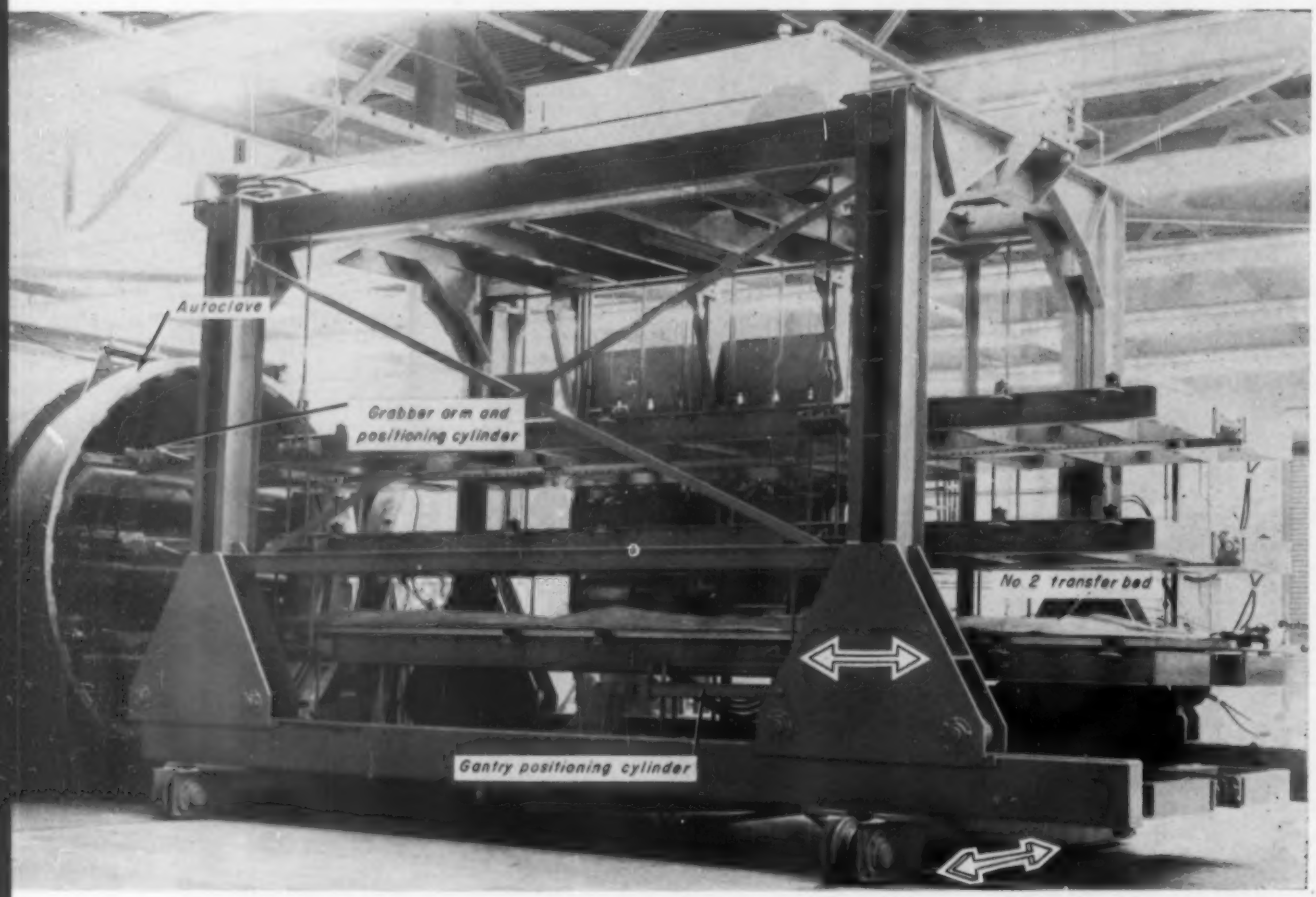
The final step determines the flow pattern through the pilot valves and whether they use an air pilot or a spring return. These two factors are decided by starting with the first cylinder to extend and determining the pilot flow needed to shift the remaining control valves in sequence.

The four circuits illustrated are examples of different sequencing in two and three-cylinder circuits. ▼▼▼

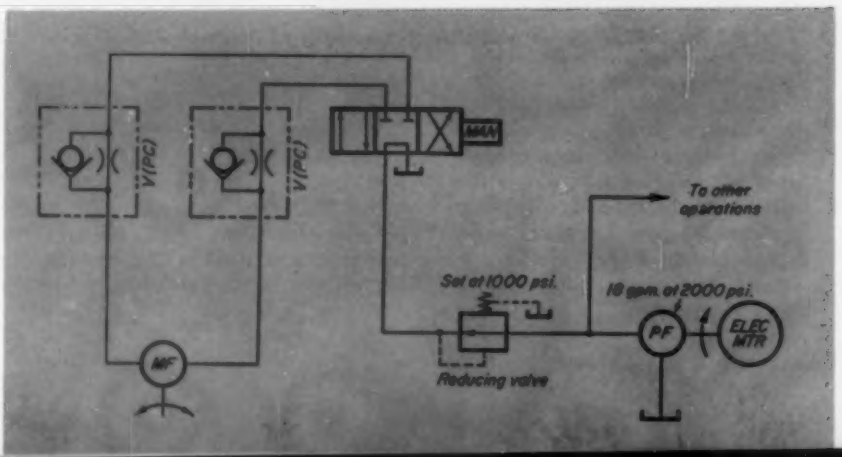
8-hp fluid motor drives giant

• By D. BERGELIS,
Rohr Aircraft Corp., Riverside, Calif.

MANUFACTURING and design engineers at Rohr Aircraft Corporation developed an oil-powered transfer machine which handles heavy sheets (some are 20 feet long), in and out of bonding furnaces. Requirements were laid down by the manufacturing engineers who had a production problem which they felt could be solved by special handling equipment.



TWO OF THE THREE TIERS in the autoclave are loaded. Load on No. 2 transfer bed is indexed and ready to go into the autoclave.



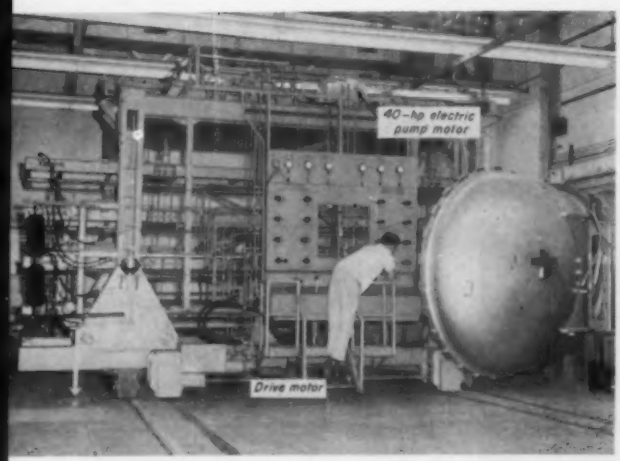
DRIVE MOTOR CIRCUIT includes reducing valve to hold pressure under 1000 psi on gear motor.

material loader 120 fpm

"We have three autoclaves being used to bond aluminum and magnesium aircraft parts, such as wings, fairings, skin sections, and cabin decks. They are parallel to each other about 18 feet apart. Each has three tiers on which material is loaded and unloaded. Using high lift fork trucks to handle the material is slow and hazardous. Can't we get a special loader, traveling on rails to shuttle between the autoclaves and take care of all the handling?", asked the manufacturing engineers.

The first step toward answering this request was to analyze the motions:

1. The entire unit must travel about 80 feet between make-up tables, where material to be bonded is prepared, and the autoclaves. This could be done by propelling the unit on guide rails in the floor in front of the autoclaves.
2. The structure should be similar to a gantry, so that once positioned in front of the autoclave it can move in and out to permit operation of the hinged autoclave door.
3. The work which is a transfer sheet holding metal bonding dies and panels to be bonded—an awkward and tremendous weight—must be positioned into and out of the autoclave. And it must be moved on and off a stationary make-up table.



• **One power source**—Construction of the loading machine is shown in the photographs. It is 23 feet long, 8 feet wide and weighs 7½ tons.

Hydraulics was selected to power all motions because:

1. Heavy loads have to be raised and lowered.
2. Fluid power can be easily carried to the many points on the machine where motion and force is needed (550 feet of fluid lines are used).
3. Force and torque is applied with a small actuator when compared to other power sources to do this job.
4. Amount of force and speed is easily regulated over a wide range.

A 40-hp, electric, double end motor drives two pumps. The pumps are vane units rated at 2000 psi. One delivers 10 gpm, the other, a double pump, delivers 20 gpm.

The circuit is piped so that the double pump powers the driving fluid motor. The single pump supplies: the conveyor fluid motor on each of the four transfer beds, two positioning cylinders on each transfer bed, and two gantry-movement cylinders.

A total of 30 gpm from both pumps is combined to power the single 7-inch diameter, 8-foot stroke lifting cylinder which raises and lowers the transfer beds through cable and sheaves. Small, 1⅛ x ¾ inch cylinders operate as index and locking devices as the transfer beds are moved.

• **Drive motor**—This motor develops about 8 hp at 1000 psi and full delivery from the pump. It drives the axle of two rubber-tired wheels through a gear box. Weight of the loading machine is on four railroad track wheels. Traveling speed can go up to 120 fpm. It's controlled by flow control valves in both directions.

Smaller motors, about 4 hp at 1000 psi, drive the conveyors on each transfer bed. The chain conveyor moves the transfer sheet off and on the bed. ▼▼▼

OPERATOR AT THE CONSOLE rides along with the loading machine. Each operation is started by hand-controlled, pilot valves which operate main directional controls.

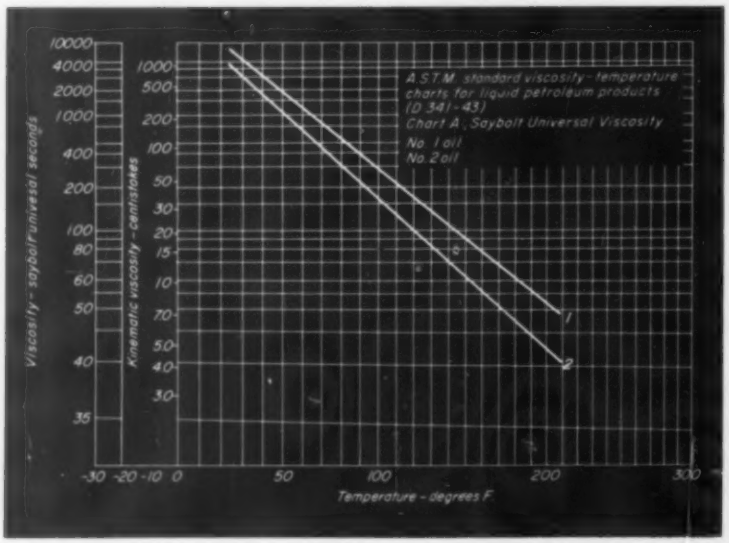
LOAD IS BEING TAKEN ONTO THE LOADER from the make-up table. After this No. 1 transfer bed is loaded, it will drop down and No. 2 bed will index down to work table height for loading. Then it will drop down and No. 3 bed will lower to the table. While the No. 4 bed is being loaded all beds are nesting below work table height. The lift cylinder raises all beds through cables to unloading positions.

	English System	Metric System
Absolute Viscosity—μ	$\frac{\text{lb-sec}}{\text{in}^2} = \text{Reyn}$ $\frac{\text{Centipoise}}{6.9 \times 10^6} = \text{Reyn}$	$\text{Stokes} \times \rho^* = \text{Poise}$ $\frac{\text{Dyne-sec}}{\text{cm}^2} = \text{Poise}$ $\text{Reyns} \times 6.9 \times 10^6 = \text{centipoise}$
Kinematic Viscosity—ν	$\frac{\text{Reyn}}{\rho}$ $\frac{\text{in}^2}{\text{sec}}$ $\frac{\text{Centistokes}}{644}$ No units for kinematic viscosity in English system	$\frac{\text{Poises}}{\rho} = \text{Stokes}$ $\frac{\text{cm}^2}{\text{sec}} = \text{Stokes}$

*ρ = Mass density, approx. 0.9 in Metric system for oil.

Converting viscosity units

• By R. W. BLACK, *Hydraulic Engineer, Machine Tool Div., Brown & Sharpe Mfg. Co., Providence, R. I.*

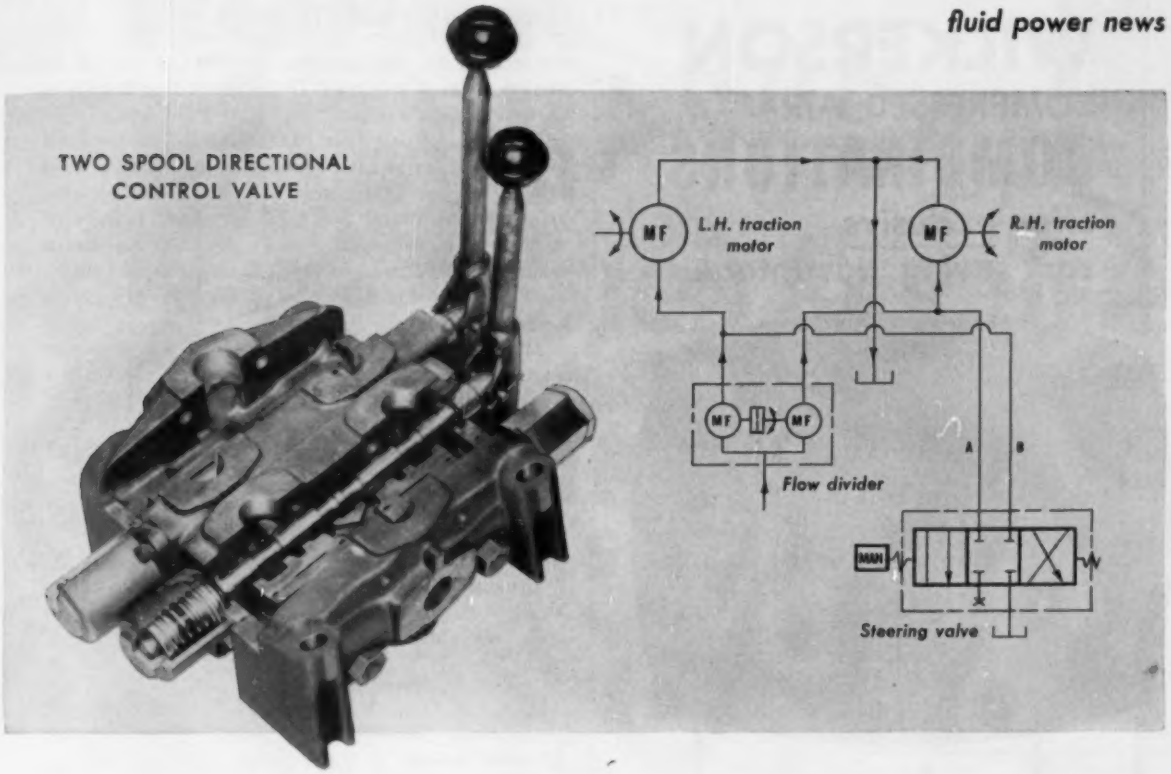


VISCOSITY is the opposite of fluidity. Viscosity is the resistance offered by a fluid to the relative movement of its parts. It is the proportionality factor in oil in much the same manner that the modulus of elasticity, E, is the proportionality factor in solids. In hydraulic circuits, viscosity is important in determining forces, leakages, and line losses.

Consider two flat plates with a film of oil between them. The force needed to move the top plate past the fixed bottom plate depends on viscosity of the oil.

If a force of one pound is required to move a one-square-inch top surface at a velocity of one-inch per second, the surfaces being

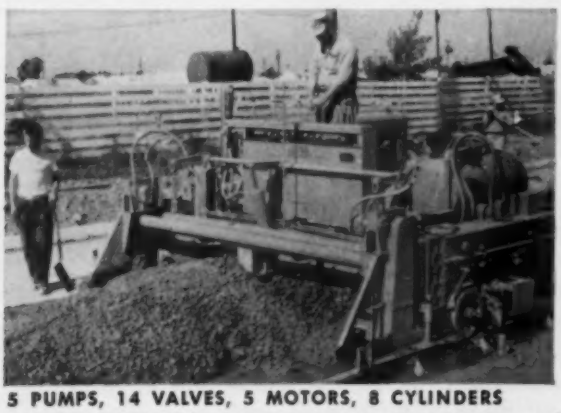
Continued on page 80



How oil hydraulics speed concrete spreading

Fluid power components by COMMERCIAL provide unique operating features on the new all-hydraulic Jaeger JSX self-widening, variable speed spreader-finisher. Forward or reverse, raising or lowering of screw and screed, and variable travel speeds are all provided for by simplified directional controlled valving of fluid power.

Fluid power is generated by five hydraulic pumps in tandem rotating in unison on a single thru shaft. Only one flange connection is required for in line coupling to the 37.5 hp engine. Manual operation of the spools of the working sections directs the discharge of each pump separately or in various combinations to the muscles of the machine – its motors and cylinders. A total of five motors together with eight cylinders, all hydraulic, actuate all the movements of the equipment such as the drive, lift, angling of the screed, traction wheel movement, frame extension and conveyor screws.



5 PUMPS, 14 VALVES, 5 MOTORS, 8 CYLINDERS add up to 100% fluid power components by COMMERCIAL. Two of the motors function as a flow divider.

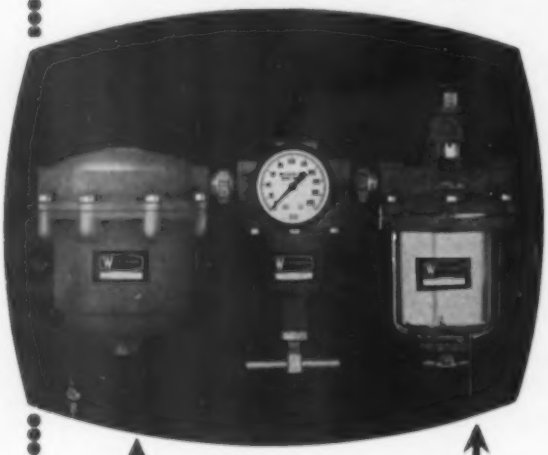
Equal or controlled variable flow. Two fluid power "four speed" traction motors drive the tramming wheels either forward or reverse. A flow divider maintains equal input to each of the two motors. To negotiate curves, a unique application is made of a COMMERCIAL 3 way, 3 position directional control valve. No flow takes place through this valve when its spool is in neutral position. Its function is to bleed flow from either of the traction motors . . . "short circuiting" the oil supply to one motor, thus reducing its speed.

COMMERCIAL's technical service in the circuitry and application of fluid power components is yours for the asking. And, for the story of how variable speeds are provided by joining in various combinations the outputs of more than one pump, write for Bulletin 100-P15. Address inquiries to Commercial Shearing & Stamping Company, Dept. A-27, Youngstown 1, Ohio.

pumps, valves, cylinders, motors

COMMERCIAL shearing & stamping

WILKERSON
COMPRESSED AIR
COMBINATIONS
offer *exclusive*
cost saving advantages



"ATOMIZER" LUBRICATOR

- Automatic internal variable venturi orifice
- Lubricates from 1 to 1200 CFM
- Transparent or metal bowls
- Fill while air pressure is on
- Force feed principle with Site-Flo gauge
- Tamper-Pruf adjustment available
- Two fill holes

"DIATROL" REGULATOR

- Non-chattering, self-relieving
- 3 outlet ports
- Large diaphragm area
- Big ports and valve opening
- Tamper-Pruf adjustment available
- Low pressure drop

"WILK-O-MATIC" FILTER

- Self-draining as air is used.
- Removes harmful moisture and contaminants as small as 5 microns
- Metal bowl eliminates breakage
- 10—250 PSI—Low pressure drop
- Will cycle over three million times without failure
- Reusable cleanable filter
- No drain line needed

Wilkerson WILK-O-MATIC combinations are available in threesomes or twosomes.

WRITE for Wilkerson Circular #1026 with complete information on all Wilkerson combinations.

WILKERSON CORPORATION

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Dedicated to keeping the NEW in pNEUmatics

Circle **144** on Time-Saver Card

CONVERTING VISCOSITY UNITS

one-inch apart, the absolute viscosity of the oil in English units is one reyn. It is evident that a reyn is an enormous viscosity.

If a force of one dyne (.00000225 lb.) is required to move a one square centimeter top surface at a velocity of one centimeter per second, the surfaces being one centimeter apart, the absolute viscosity of the oil in metric units is one poise. Water has a viscosity of 0.01 poise at 20 C. The centipoise (poise/100) is a common expression of absolute viscosity in metric units.

The relation governing the moving of one plate past another is:

$$F = \mu \frac{VA}{h}$$

F = force
μ = absolute viscosity
V = velocity
A = surface area
h = distance between plates

Usually μ is converted from absolute English to absolute metric by converting lb-sec/in² to Dyne-sec/cm². This is usually expressed:

$$\mu \text{ (reyns)} = \frac{\mu \text{ (centipoise)}}{6.9 \times 10^6}$$

Kinematic viscosity ν is the absolute viscosity divided by mass density ρ. Mass density is the weight per unit volume divided by acceleration of gravity. In English units ρ becomes 62.4/1728 x 386 for water. In metric units, the mass density is the same as the specific gravity, and the specific gravity is:

$$SG = \frac{\text{specific weight of liquid}}{\text{specific weight of water}}$$

SG is usually 0.9 for oil. In the metric system, the mass density ρ is the same. The actual SG can be measured by floating a hydrometer in the oil.

Viscosity of oil decreases with increasing temperature. There is no equation for the relationship between viscosity and temperature. It varies from oil to oil. Viscosity at a particular temperature is commonly measured on a Saybolt Second Viscosimeter, which measures time, in seconds, for 60 cc of the oil to flow through a fixed orifice.

Viscosity-temperature charts of the American Society for Testing Materials are very useful. If the viscosity of an oil is known at two temperatures, its viscosity at any third temperature can be found on the straight line connecting the first two points. This chart can also be useful in mixing oils. The chart shown has the added feature of an ordinate marked in centistokes (kinematic viscosity in metric units). Values were derived from the expressions:

$$\nu \text{ in centistokes} = .226t - \frac{195}{t} \quad \text{for } t < 100 \text{ sec. SSU}$$

$$\nu \text{ in centistokes} = .220t - \frac{135}{t} \quad \text{for } t > 100 \text{ sec. SSU}$$

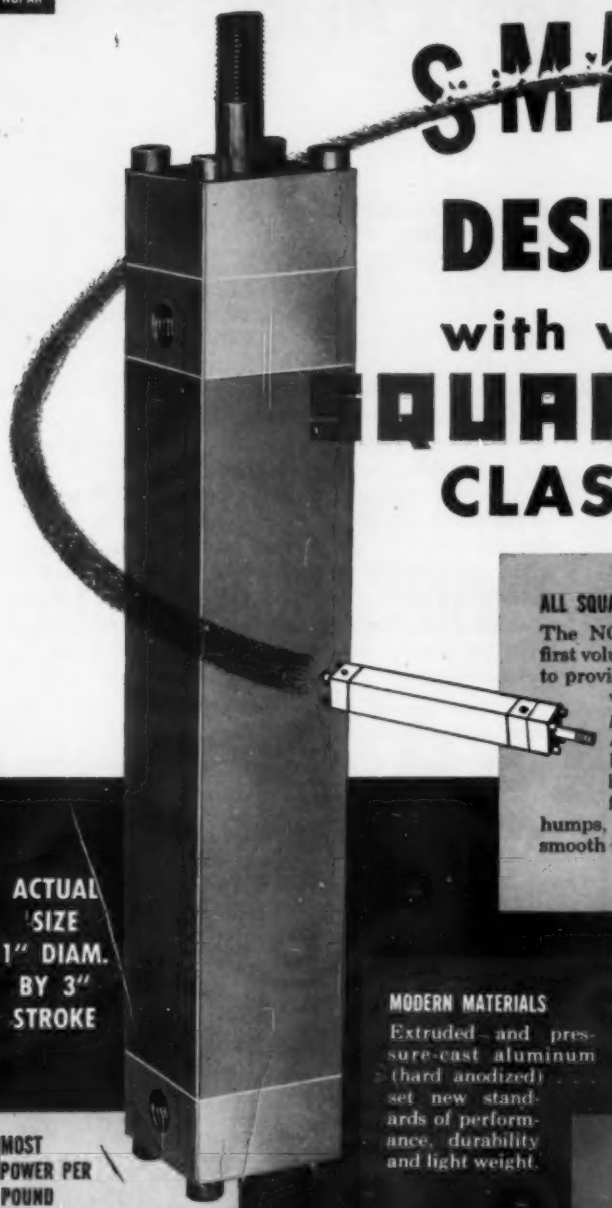
There is no unit for kinematic viscosity in English units. Generally the conversion is made by changing cm²/sec to in²/sec, or more simply by dividing centistokes by 644. ▼▼▼

Circle 52 →

another Plus Value by NOPAK

NOPAK SMASHES DESIGN BARRIER

with world's first SQUARE BARREL CLASS 7 CYLINDER



ACTUAL SIZE 1" DIAM. BY 3" STROKE

ALL SQUARE CONTOUR

The NOPAK Class 7 is the first volume produced cylinder to provide the spectacular advantages of the *complete all-square* design. Aligning the square heads with a square barrel results in four flush sides . . . no humps, no bumps, only clean, smooth lines throughout.

NEW MOUNTING CONCEPT

Only NOPAK's exclusive Square Barrel can give you this unique mounting! Mounting holes can be drilled or tapped directly into cylinder tubing, either longitudinally or at right angles. Cylinder heads can be similarly utilized.

MODERN MATERIALS

Extruded and pressure-cast aluminum (hard anodized) set new standards of performance, durability and light weight.

MOST POWER PER POUND

Aluminum barrel . . . aluminum heads . . . no tie-rods . . . give the Class 7 cylinder the greatest power-weight ratio available.

MINIMUM SPACE

With or without heads, and tie rods eliminated, this Square Barrel cylinder can be built into your machine as an integral unit . . . *in less space than any competitive cylinder.*

VERSATILE, ADAPTABLE

Quick-change mounting attachments in various combinations of foot, flange, clevis or trunnion can be used to meet a wide range of application requirements with *one* basic cylinder.

CLEAN LINES

No tie-rods, no complex head locks, no uneven dirt-catching surfaces . . . make the NOPAK Class 7 Square Barrel a must for food processing, vending machinery, clinical equipment or any place where sanitary conditions or neat appearance are paramount.

STACK COMPACT

Because of their contour, Square Barrel cylinders can be stacked one above the other or mounted side by side in the smallest possible space.

Write for Catalog 107

NOPAK *VALVES and CYLINDERS*

GALLAND-HENNING NOPAK DIVISION
2743 S. 31st Street
MILWAUKEE 46, WIS.

What you can do about shock

SHOCK is a big cause of hydraulic component failure. The instantaneous pressure surge when a valve shifts, or a cylinder ends its stroke can be well above the pressure rating of many circuit components. The vibration that accompanies shock shakes mounting bolts and fittings loose and causes leaks.

It is not nearly as hard to find the source of the shock as to eliminate it. Its basic cause is the rapid stopping or changing direction of a fast moving column of oil. Valves, cylinders, and fluid motors are the most common shock generators.

• **Valves**—Shock from a valve is directly proportional to its closing speed. Since the valve actuator determines how fast the valve shifts, let's see how we can slow down the actuator.

On a direct-acting solenoid valve, any attempt to slow valve shifting makes the solenoids overheat, because the inrush current holds too long. The valve spool or shifting member must be modified to cut off flow more gradually, Figure 1.

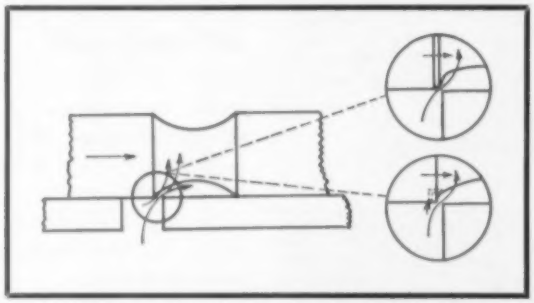


FIG. 1. SHOCK DEVELOPS when the spool land moves right and abruptly stops flow. Grinding a slight angle on the spool cutoff edge makes the valve gradually shear the moving column of oil. This reduces shock. Another way is to drill small holes in the spool near the cutoff edge. As the spool moves right and cuts off the flow passage, a little fluid passes through the holes until they are covered by the valve body.

You can control speed of *pilot-actuated* valves by regulating pressure and flow to the actuators. Most pilot valves have built-in, adjustable chokes to restrict pilot flow.

• **Cylinders**—Most standard cylinders have cushions at the extreme ends of their stroke. The cushions have an adjustable needle valve to control cylinder discharge flow and bring it to a smooth stop. However, if the piston is stopped or reversed during its stroke, kinetic energy of the moving parts can cause severe shock. Small relief valves at the cylinder ports will relieve this shock. They should be set 5-10% above maximum working pressure. A spring-loaded, poppet type relief valve works best because it reacts fast to pressure surges.

A slow closing, deceleration valve, operated by a cam on the piston rod, will also reduce shock.

Similar remedies used for cylinders will work with fluid motors.

• **Circuits**—To reduce troubles from vibration, keep hydraulic lines between pumps, valves, and cylinders as short as possible, and avoid unnecessary bends. Use flexible hose to absorb shock wherever possible.

A properly located accumulator will do much to reduce shock. It should be piped into the circuit as close as possible to the source of the shock. A bladder type accumulator works best for reducing shock because it has little inertia.

In circuits where cycle time does not permit shock elimination, these special precautions should be taken. ▼▼▼

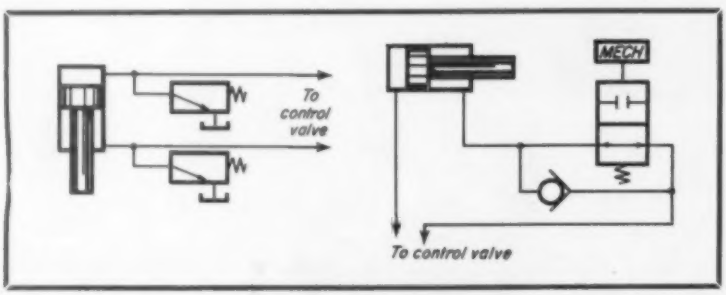


FIG. 2. POPPET TYPE RELIEF VALVES at each cylinder port help relieve cylinder shock. A deceleration valve actuated by a cam on the piston rod also reduces shock.

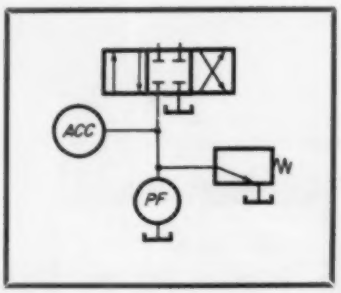
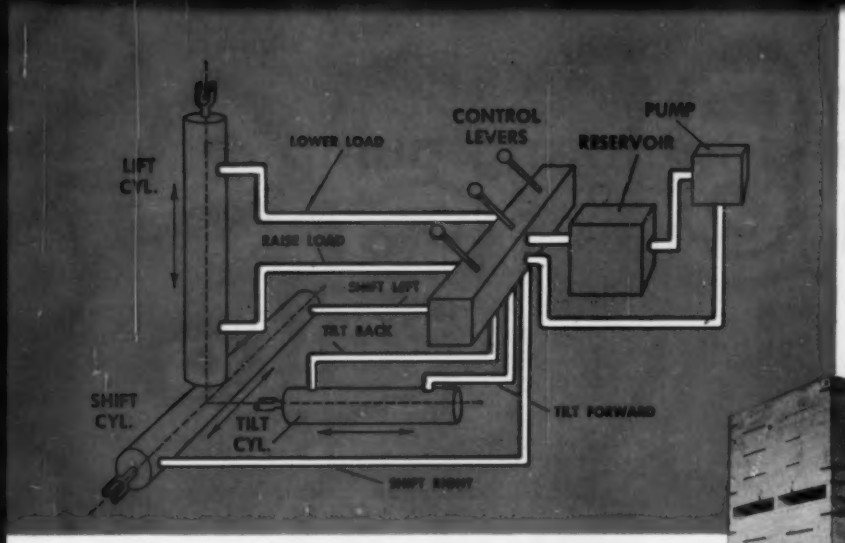
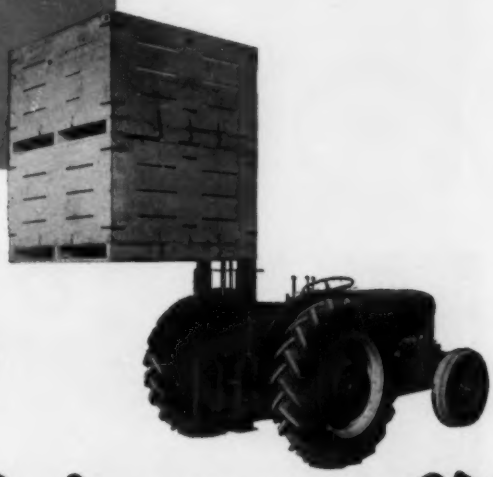


FIG. 3. AN ACCUMULATOR USED as a shock absorber should be piped into the circuit as close to the source of the shock as possible.



Schematic drawing of hydraulic system in Blackwelder Fork Lifts, built for every farm material-handling operation. White lines indicate Gates Hose for hydraulic fluid operating lift, tilt and shift cylinders.



Gates Hose helps Blackwelder Fork Lift

lower costs...pick up profits!

"We've been using Gates wire-reinforced hydraulic hoses on our Blackwelder Tractor-mounted Fork Lifts for years," says Fred Hill, Chief Engineer for the Blackwelder Manufacturing Company, of Rio Vista, California, makers of farm material handling equipment. "Their exterior cover and durable inner tube make them ideally suited to withstand the rough abrasion and temperature conditions under which our equipment is operated. We know our hydraulic components will function properly with Gates Hose assemblies, and our customers benefit by keeping maintenance to an absolute minimum!"

Immediately available in all major markets

Gates Hydraulic Hose — built to meet or exceed SAE specifications — is available nation-wide in wire-braided and horizontal-braided construction in a complete range of sizes, for medium-pressure or high-pressure use. Ask your nearby Gates Distributor, for Gates Hydraulic Hose Assemblies booklet, IH 43.

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Gates Hydraulic Hose / Made in a Full Range of Sizes Medium-Pressure, High-Pressure

Circle **56** on Time-Saver Card

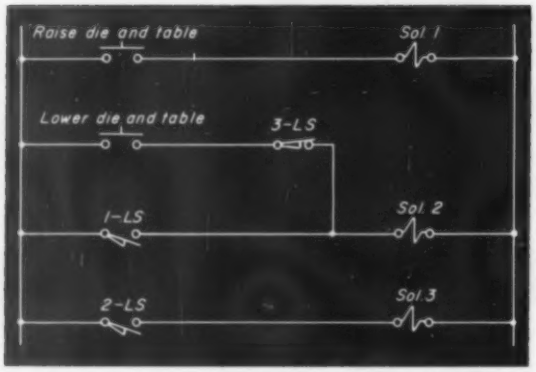
Variable speed metering pump controls reel traverse

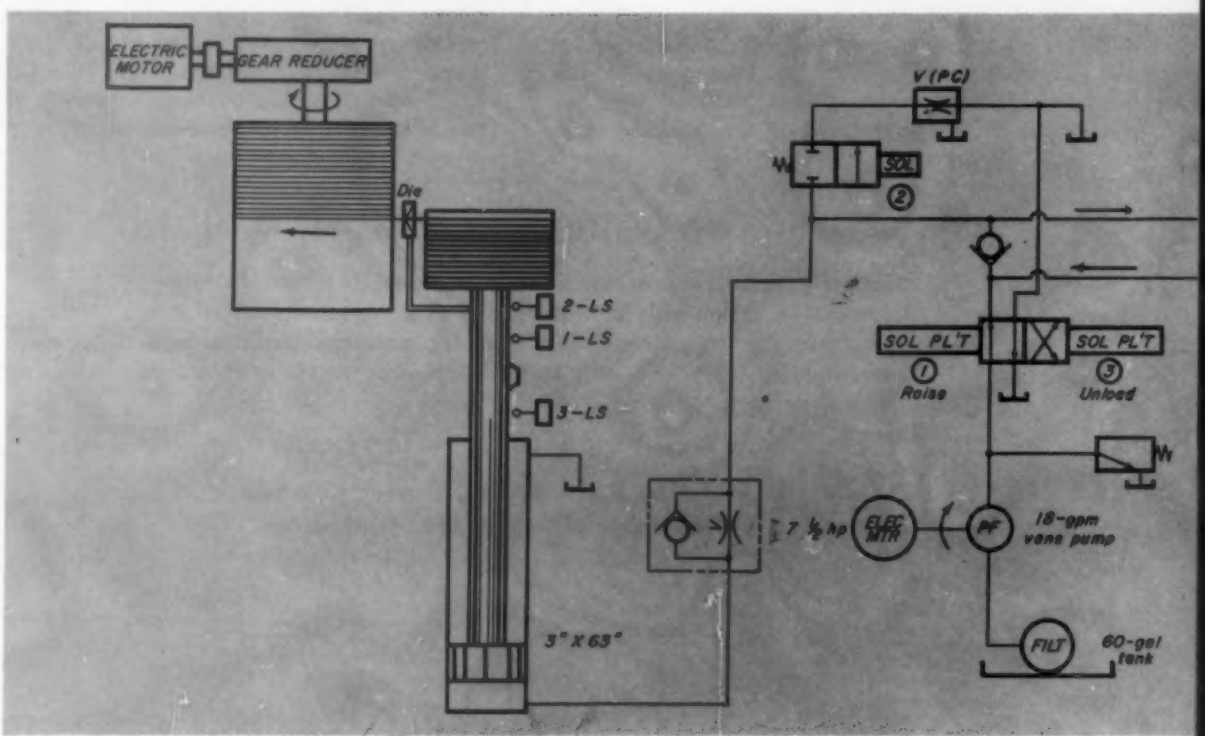
• By J. I. McMARTIN,
Chief Engineer
The Fenn Manufacturing Co., Newington, Conn.

IN WINDING up copper tubing after drawing, a controlled traverse is required to lay the tubing evenly on the reel. Traverse speed depends on tubing OD. As tubing size increases, traverse speed must also increase. This variable speed requirement can be met by several speed control methods of traversing the drawing die across the wind-up reel.

In a Fenn designed machine, die traverse speed is controlled by metering flow from a cylinder through a small pump driven by a variable speed, d-c motor. Motor speed is controlled by an electronic unit which operates from an a-c supply.

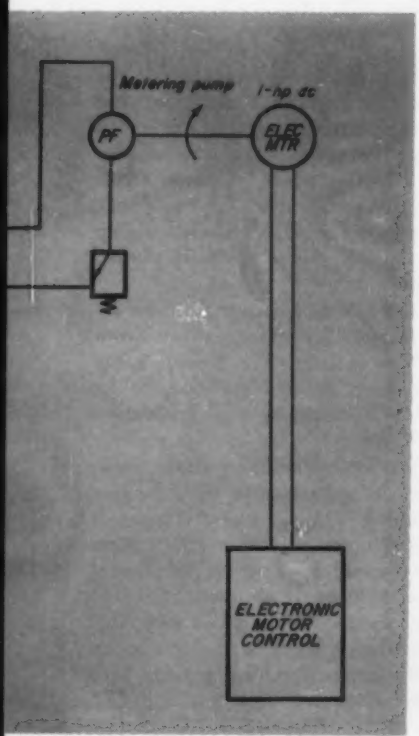
Referring to the hydraulic and electrical diagrams, the cylinder which carries the die and payout reel is raised by flow from an 18-gpm, constant speed pump. Near the top of its stroke, the cylinder actuates limit switch 1-LS which energizes solenoid 2. This bypasses pump flow so the cylinder slows down until it actuates 2-LS at the top of its stroke. This energizes solenoid 3, shifting the 4-way directional valve to unload the 18-gpm pump and provide a tank connection for the metering pump. Limit switch 1-LS is also deactuated as the cam rides off of it, so that the spring-loaded 2-way bypass valve closes.



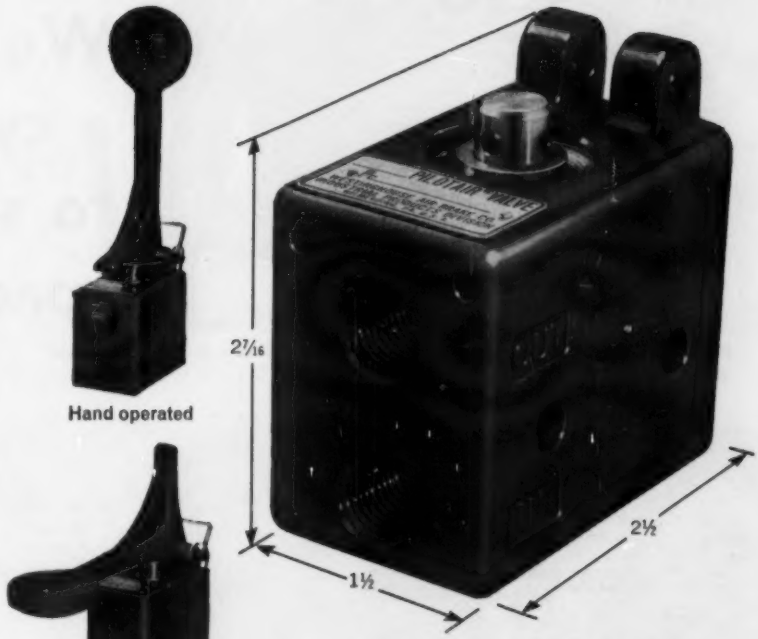


The cylinder now drops at a rate controlled by flow through the metering pump. The trip dog for limit switch 1-LS is designed so it does not operate 1-LS on the way down. A relief valve in the metering pump's outlet line counterbalances the cylinder.

The electronic motor control operates from an a-c line and converts to dc with two, full wave, center-tapped rectifiers. One of these supplies the motor's armature, the other supplies its field. Speed responsive to drum speed is controlled by adjusting armature voltage with a tachometer generator. Speed responsive to tube diameter is controlled by adjusting the ratio between input from the tachometer generator and output to the armature by a rheostat at the operator's control console. Motor speed is maintained within 2% of setting. ▼▼▼



another new Westinghouse AIR CIRCUITRY Component



Hand operated

Foot operated

Air pilot operated

Cam roller operated

Cam dog operated

Type "A" PILOTAIR® Valve

Don't let the size of these little poppet-type directional valves fool you.

They can open, close or vent an air circuit as quickly, efficiently and dependably as models twice their size.

For despite their compactness (actual dimensions are 1½" x 2½" x 2 1/16"—and they weigh less than 16 oz.), the short travel action of poppet valve construction produces fast response for full valve capacity.

Type "A" PILOTAIR Valves are enclosed in a solid, die cast aluminum block for ease of installation and ruggedness. They are designed for lever, mechanical or air operation. Maximum inlet pressure is 250 psi. Maximum operating temperature is minus 40°F to plus 200°F. Pipe taps are ¼" N.P.T.

AIR CIRCUITRY—FOR TROUBLE-FREE AUTOMATION

Air Circuitry is the application of pneumatic control systems to industrial production operations.

Air circuits are safe, economical and precise and are used to solve the most rigorous and complex control problems in industry.

Our engineers, backed by 90 years of experience, can help you boost production and cut costs in your plant.

AIR CIRCUITRY means trouble-free automation

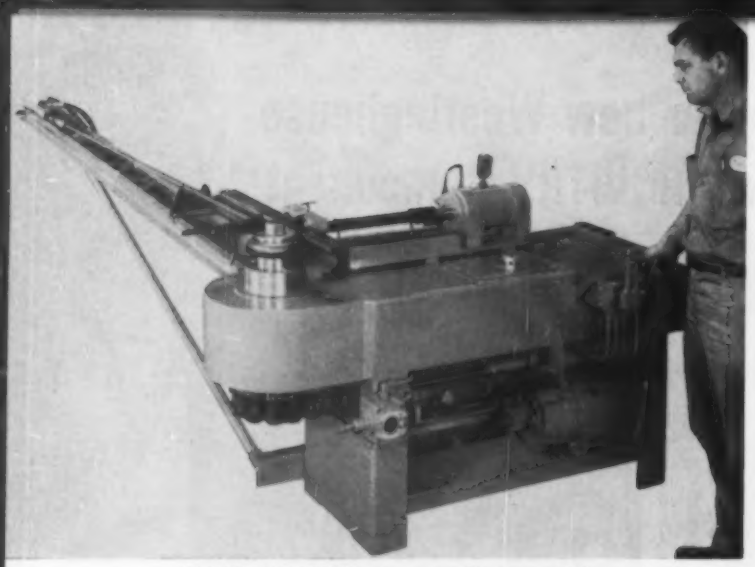
For more information, ask for Catalog A4-74:00

See the Yellow Pages under Cylinders for the Name of Your Local Distributor, or refer to Sweet's Catalog, Product Design File.

WESTINGHOUSE AIR BRAKE COMPANY

INDUSTRIAL PRODUCTS DIVISION, WILMERDING, PENNSYLVANIA

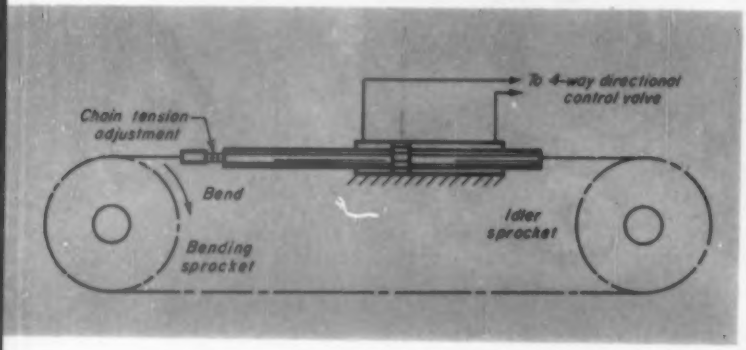
Circle **143** on Time-Saver Card



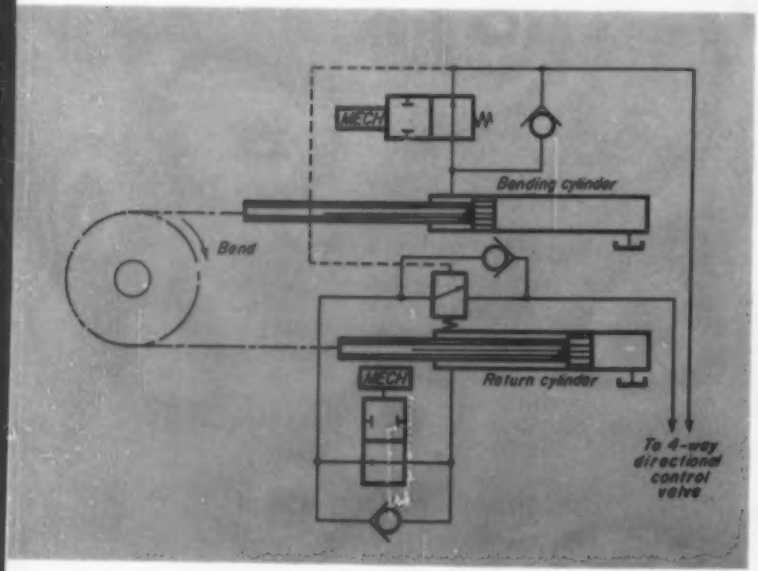
COMPACT DESIGN has pump flange-mounted on electric drive motor.

We added a cylinder to save space

• By **JOHN COSTELLO,**
President
Costello Engineering Co., Inglewood, Calif.



SINGLE CYLINDER, bender design has an endless chain which passes around an idler sprocket and a bending sprocket. It requires a chain tension adjustment to take up slack.



TWO-CYLINDER bender design eliminates one sprocket and keeps chain at proper tension with a counterbalance valve. Deceleration valves which shut off oil flow act as stops to control bending angle. Cylinder driven cams actuate the valves.

A PIPE BENDER which we designed for the Navy had to be small and light for use aboard a submarine tender under very cramped conditions. Heavy construction contractors also need a compact bender which is easily transported from job to job, and in shipyards they must be able to swing a bender aboard a ship being built or repaired where the work cannot be done in a shop.

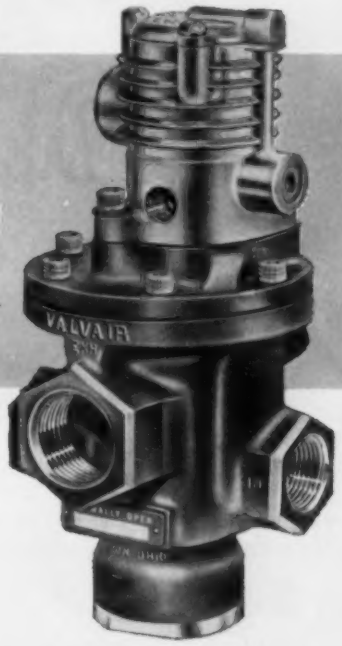
We shortened the length of our machine by going to two cylinders instead of one as shown in the figures. This re-design also brought other advantages. We have reduced maintenance by eliminating chain adjustment, and lubrication of one sprocket. We now have a more positive drive, because we have eliminated chain slack, and we can get optimum tension on the chain which is not pulling. This tension is critical: it must be adequate to prevent the chain from walking off the sprocket, but not so high that it causes wear and reduces net torque transmitted to the sprocket. In the 2-cylinder design, this tension is adjusted with a counter-balance valve. Chain wear and eccentricity of the sprocket have no effect on performance. ▼▼▼

split-second response!

more work per hour!

with **Valvair®** **HI-SPEED INLINE VALVES**

- **solenoid coil guaranteed against burn-out for life of valve**
- **instant-action control • air-cushioned poppet**
- **multi-million cycle dependability • JIC pilot**



HI-SPEED INLINE with integral pilot, 2- or 3-way, NO or NC, ⅜ to 1¼ in. NPT.

Short poppet travel in Valvair's HI-SPEED INLINE provides maximum flow almost instantaneously. This shortens machine cycle time . . . lessens brake and clutch slip . . . provides more accurate cuts on high speed cut-offs . . . decreases set-up time . . . minimizes drift, for safer operation.

For increased production . . . lower costs . . . greater safety . . . specify Valvair HI-SPEED INLINE valves.

Write for free Bulletin HIN. Address: Bellows-Valvair, Akron 9, Ohio, Dept. AH-760.

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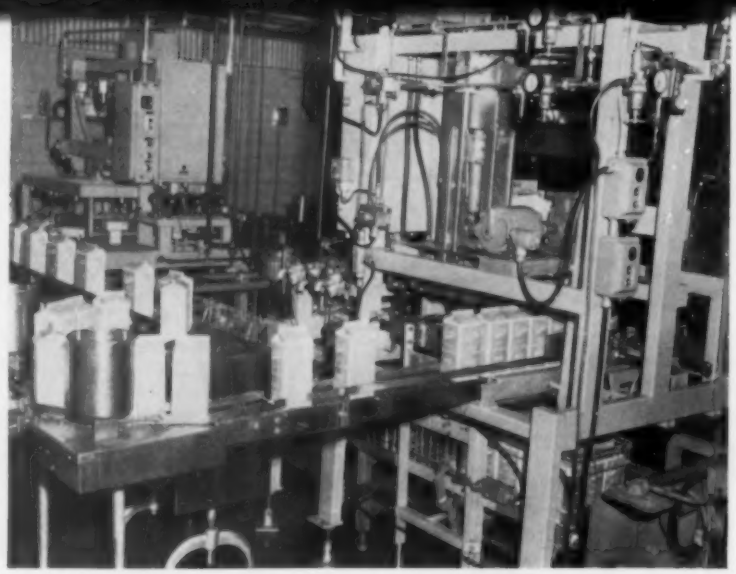
The Bellows Co. • Valvair Corp. Akron 9, Ohio

DIVISIONS OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

8110-3

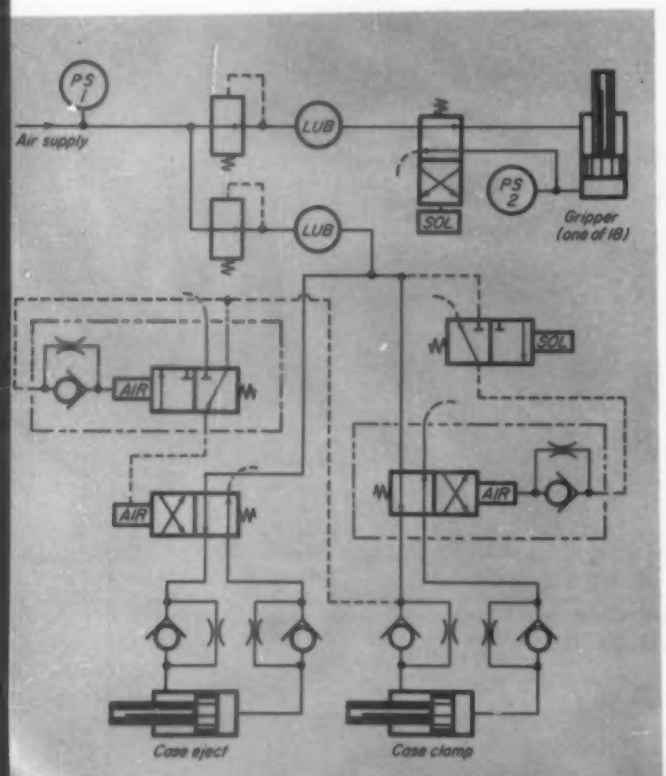
Control valves assembled from standard components are a big help to circuit designers. In this circuit three different air actuators are used on the control valves. The valve bodies are standard, only the actuator heads change to alter the valve.



A HYDRAULIC CIRCUIT interlocked with a pneumatically timed, air circuit controls operating sequence on this milk carton caser.

Modular air valves give timed sequencing

• By **DON McLEOD**, *Multifold Corp., Milford, Ohio*
and **WILLIAM DEAS**, *Henry M. Wood Co., Cincinnati, Ohio*



IT'S good practice to keep spare valves on hand for each type in service. In a plant with many air circuits, this could be costly and require considerable space. Using modular valves reduces stocking requirements.

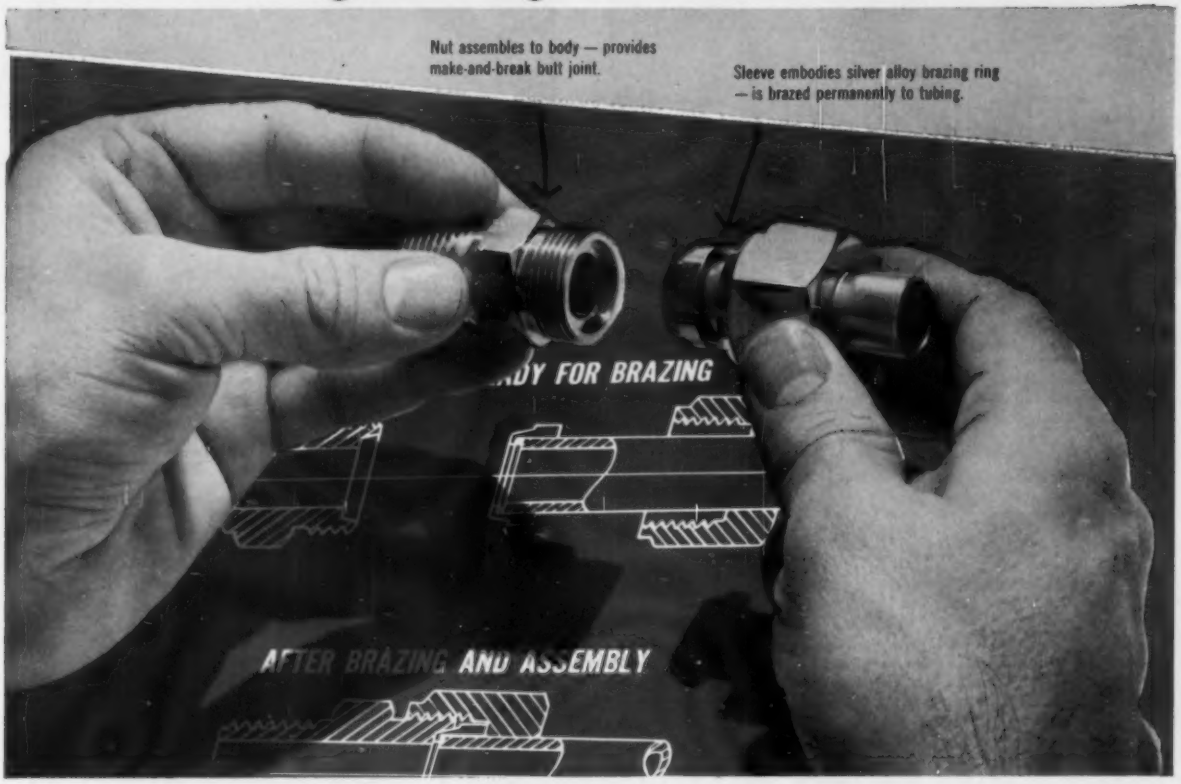
With modular construction any type of air operated valve can be built up by assembling standard components. By stocking the valve components, a replacement valve can be assembled in minutes.

The Multifold Corp. has an air circuit on one of their milk carton packaging machines that uses two 3-way valves and two 4-way valves. Each valve has a different type of actuator. The air circuit positions empty cases, ejects full cases, and opens and closes gripper jaws that hold the milk cartons while casing them. A hydraulic circuit controls all other movements on the machine.

• **Grouping Cartons**—A moving conveyor advances filled cartons to the casing machine in single file. A

THREE TYPES OF AIR ACTUATORS sequence the cylinders. One actuator delays valve operation by metering air in, another meters air out of the actuator. The third type actuates with no delay in either direction.

IMPERIAL
Engineering and Data File


Nut assembles to body — provides make-and-break butt joint.
Sleeve embodies silver alloy brazing ring — is brazed permanently to tubing.
AFTER BRAZING AND ASSEMBLY

NEW BRAZE-SEAL TUBE FITTING

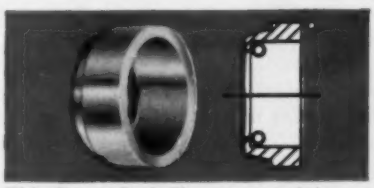
WITHSTANDS SUPER-PRESSURES, HIGH TEMPERATURES . . . RETAINS MAKE-AND-BREAK CONVENIENCE

Until Imperial Braze-Seal came along, engineers could not specify an economical make-and-break fitting for tubing circuits involving super-pressures and high temperatures. Applications like these called for welded connections. But now Braze-Seal offers high reliability, even under extreme pressures. (See chart below.)

MAXIMUM DESIGN PRESSURES (PSI) FOR BRAZE-SEAL FITTINGS

Tube O.D.	316 Stainless	Carbon Steel
3/8"	64,000	48,000
1/2"	62,400	46,800
9/16"	61,600	
5/8"	61,600	46,200
3/4"	60,000	45,000
7/8"	56,000	42,000
1"	52,000	39,000
1-1/4"	48,000	36,000
1-1/2"	44,000	33,000

Application of the following safety factor is recommended: 4 to 1, for sizes up to ⅝" O.D.; 6 to 1, for sizes ¾" to 1½" O.D.



This Braze-Seal Sleeve, containing a silver alloy brazing ring, is the key to the performance of the Braze-Seal Fitting. It assures a joint that will withstand these extreme pressures because it is permanently brazed to tubing. Yet the fitting provides the convenience of a make-and-break butt joint, as illustrated, and is extremely easy to assemble.

Reducing Sleeves Provide Versatility

Can be furnished to reduce any size Braze-Seal tube end to any specified tube size. Extremely convenient on tees, for example, where any size tubing can be connected to the same tee body. Also, the same body may be used for making up flareless Hi-Seal fitting joints.

Imperial Braze-Seal Tube Fittings can be furnished in steel or stainless steel.

Check the outstanding features of Braze-Seal for yourself. Send for a sample fitting. See how Braze-Seal can help you solve the most difficult problems in super-pressure and high-temperature tube circuitry.

IT'S IN THE BOOK

Braze-Seal Fittings are covered in Imperial's new Hi-Seal Catalog — the most comprehensive coverage available on the subject of fittings, a hard-working handbook for engineers. Send for your copy today.

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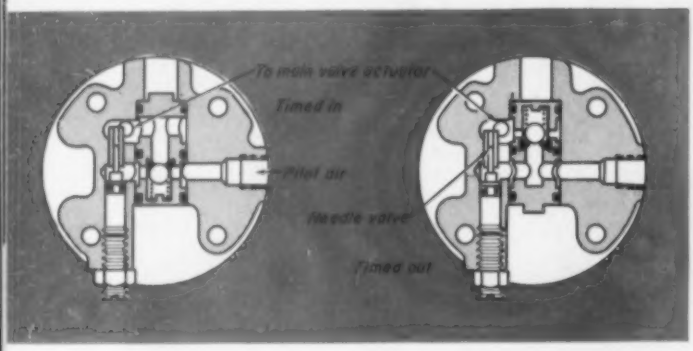
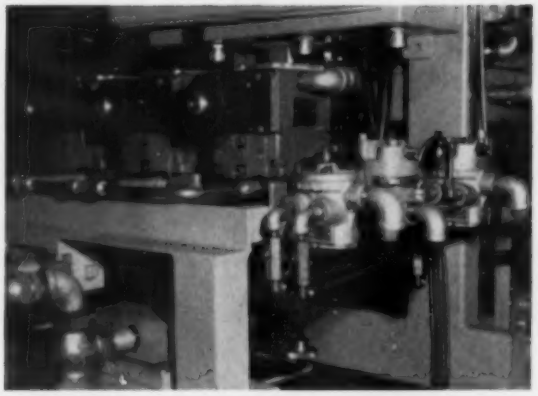
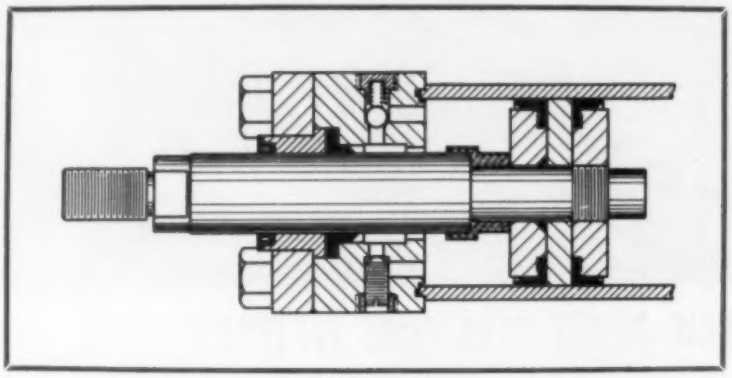
MODULAR AIR VALVES



VALVE HEAD on the left actuates the main valve after a time lag when air is applied to the pilot line. The ball check valve prevents air from going directly to the valve actuators. The air must meter through the restriction caused by the needle valve. Valve head on the right meters air out of the actuator when pilot pressure is removed. *Courtesy Ross Operating Valve Co.*



AIR VALVES have the same bodies. Their operation is changed by using different pilot heads. One head gives instantaneous actuation when pilot air is applied. The other two vary actuation time by metering air into the actuator or bleeding air out. The hydraulic valves above are double solenoid operated. Designers found that steam used to clean the machine would rust return springs even if they were plated. The solenoids are oil-immersed to protect them against steam.



A SPECIAL CUSHION on the table cylinder slows the rod about ¾" from the end of its stroke. To speed up the cycle time, the cushioning is removed before the end of the stroke.

hydraulic cylinder, at a right angle to the conveyor, pushes three rows of three cartons each onto a table along side the conveyor. When the table is full, another hydraulic cylinder, attached to the table, extends and places the cartons under air operated grippers. A parallelogram linkage raises the table as it reaches its fully extended position. The parallelogram linkage first lowers the table before it retracts so that it does not drag on the bottom of the cartons.

The table cylinder has an unusual cushion built into its rod end cap. To decelerate the cartons as they move under the gripper heads, the table cylinder has a cushion applied ¾" from the end of its extended stroke. To shorten deceleration time and speed the cycle, the cushion is removed before the end of the cylinder stroke.

● **Casing Cartons**—A limit switch, actuated when the table is fully extended, shifts the control valve closing the air-operated gripper jaws. Pressure builds up, actuating a pressure switch which retracts the table and lets the hydraulic cylinder lower the cartons into a case below the gripper heads.

When the cartons are in place in the case, a limit switch de-energizes the gripper control valve, opening the gripper jaws and releasing the cartons. The lowering cylinder retracts.

With the case in position for loading, a limit switch energizes a solenoid valve directing air to the actuator on the clamp cylinder control valve. The control valve shifts, extending the clamp cylinder. With no pressure in the rod end of the clamp cylinder, the air actuator on the case eject pilot valve exhausts the air trapped in this circuit by the previous cycle. When the clamped case is filled, a limit switch de-energizes the solenoid control valve. This gradually releases air from the actuator on the clamp cylinder control valve, allowing time for the grippers to lift clear of the case. The clamp cylinder retracts, and air from the rod end is applied to the actuator on the eject cylinder pilot valve and also goes through this valve to the actuator on the eject cylinder control valve, The control valve shifts, extending the eject cylinder. It remains extended until enough air meters in to the actuator on the pilot valve to shift the valve. When the valve shifts, the eject cylinder retracts. ▼▼▼

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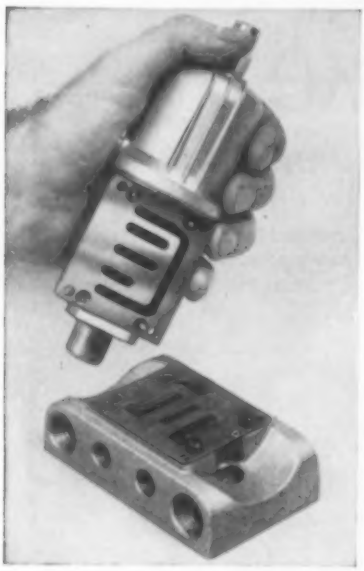
New Solenoid Air Valves Need No Accessories

Now available for the first time are solenoid operated air valves complete with all accessories at 'bare valve' prices. Available in ¼, ⅜, and ¾ in. port sizes, they come in single- and double-solenoid types in 3-way, 4-way and 4-way 5-port models.

Features include: solenoids interchangeable on all models of a given size; pre-wired plug-in type bases, eliminating customary wiring; standardization of bodies and bases for interchangeability; unusual compactness; elimination of troublesome fasteners in solenoid assembly (which floats in rubber).

All valves are equipped with screwdriver or ball type manual solenoid operators with lock-in and lock-out feature.

Manifold type bases with common inlet exhaust, and conduit, available on ¼ in. models. For complete information, ask for MAC catalog #60.

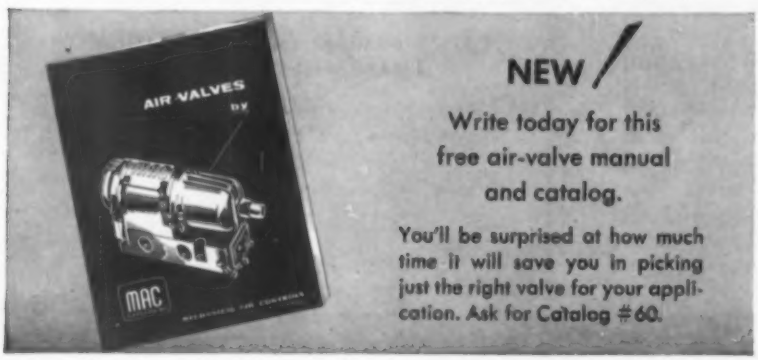


Plug-in Connectors Now Standard on All MAC Solenoid Valves

Pre-wired bases, into which you simply plug in the valve body, are now standard on all MAC solenoid valves—both direct-solenoid and solenoid-air types. Bases are identical for single- and double-solenoid valves of a given size.

The same principle is also applied to the "add-a-unit" manifold type bases available for all MAC solenoid valves. With these, from 2 to 10 valves can be coupled with common inlet, exhaust and conduit. Individual valves can also be isolated or pressure fed in from each end.

With plug-in leads provided on all solenoids, wiring of valves has been reduced to the utmost in simplicity.



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You'll be surprised at how much time it will save you in picking just the right valve for your application. Ask for Catalog #60.

advances in
PNEUMATICS

MAC

evolution of valve seals...

While metal-to-metal seals work well in hydraulic valves, where inherent leakage is accepted, positive leakproof sealing is mandatory in air valves. Flexible seals are today accepted as vital and they must be so designed that sealing efficiency increases with pressure. The seal should be self-cleaning so that foreign matter won't cause leakage.

At one time O-rings were thought to be the answer. O-rings are excellent for static sealing or where travel is short. O-rings are unsatisfactory, however, when used as valve seals crossing an orifice due to the shearing action.

Developing the best design and compound for air-valve seals was a long and tedious job, since elasticity, durometer hardness, compression set, and co-efficient of friction are also important factors.

Experience to date has proven that the best valve seal is a special Buna-N base self-lubricating oil-resistant compound—bonded to the metal to keep it from distorting.

This is the type of seal used in MAC valves. We believe it represents an ideal combination. At least, their amazingly long life in MAC valves seems to confirm that belief.

O. S. Lowney
President

MAC

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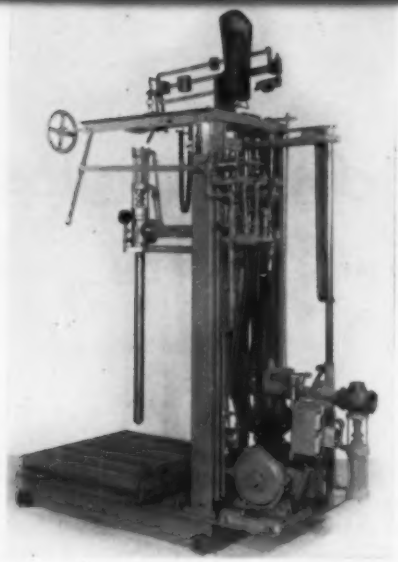
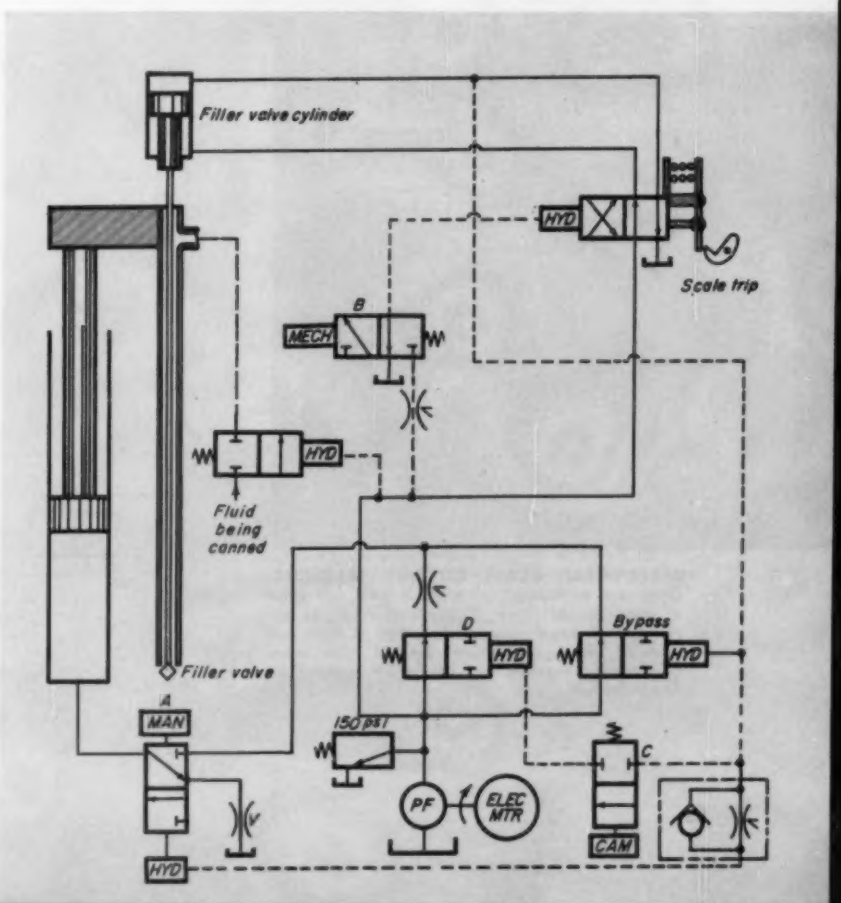


Latching control valve speeds drum filling

• By **C. D. CRANDALL**, *President,*
Crandall Can Filler Machine Co., Buffalo, N. Y.

MANY liquids foam when poured into a container. This slows filling and causes inaccurate drum weights. This filling machine avoids foaming by filling the containers through a tube which stays below the surface of the liquid. A hydraulic metering circuit lifts the tube as the fluid raises in the container. The tube remains a few inches below the surface of the liquid until the container fills. When the scale setting is reached, the fluid shuts off and the filling tube lifts clear of the container.

The valve controlling fluid flow to drums in this filling machine is operated by a hydraulic pilot. A special latch holds the valve in its actuated position until a mechanical trip releases it. The drums are filled on a scale to insure accuracy. The scale weigh bar and the control valve locking lever are mechanically interlocked. When the drum reaches its set weight, a mechanical trip releases the control valve operating lever. A spring shifts the valve's spool. This retracts the filler valve cylinder and shuts off flow to the drum. ▼▼▼



CONTAINER ROLLS ONTO THE SCALE BED from a conveyor. The operator manually shifts valve *A* allowing the cylinder to lower the filling tube into the drum. When the tube reaches bottom, cam-operated valve *B* shifts applying pump flow to the pilot of the special 4-way control valve. The valve shifts, and is locked in this position by the scale trip. Fluid enters the head end of the filler valve cylinder and the drum starts filling.

Pressure to the head end of the filler valve cylinder also closes the bypass around the flow control valve which governs speed at which the filler tube raises. This pressure also shifts valve *A* and the filler tube raises as it fills the drum.

When the tube nears the top of the drum, a cam shifts valve *C* applying fluid to the pilot on valve *D*. Valve *D* shifts, stopping upward movement of the filler tube.

When the quantity of liquid in the drum equals the scale setting, the scale trip releases the control valve. A spring shifts the spool which closes the filler valve. This releases pressure to the pilots on the bypass valve and valve *D*. The valves open and the filler tube lifts out of the drum.

Cutting glass

Designers of this machine had to find a way to run a glasscutter along a straightedge. An air motor was ideal because it was light and its speed was easy to control. Even so, just settling on an air motor did not send the glasscutter running along the straightedge. They found that the best way to move the glasscutter was to fasten it to the air motor and to have the air motor drive itself back and forth along the straigthtedge. They did this by gearing the motor to a rack mounted on the straightedge.

• By **JAMES F. BENTLEY,** *Goll-Hanford Corporation*

WITH air power, this interesting machine nearly duplicates the steps and the movements of hand glasscutting. As in handcutting, a straightedge guides the class cutter. On this machine, the straightedge is pivoted and counterweighted, like a boom. An air cylinder raises and lowers the boom, buffers it to gentle stops.

Air power drives a cutter along the straightedge held firmly against the glass, just as a handworker would do it. The cutter scores the glass. Then a breaker bar, moved pneumatically, breaks the glass along the score. Still imitating handcutting, the boom raises, releasing the glass.

• **The Cutting Circuit**—Solenoid *A*, momentarily energized, shifts the control valve. Air extends the boom cylinder, lowers the boom to rest on the glass. To cushion the fall of the boom so it will not break the glass, the engineers added a cushioning circuit.

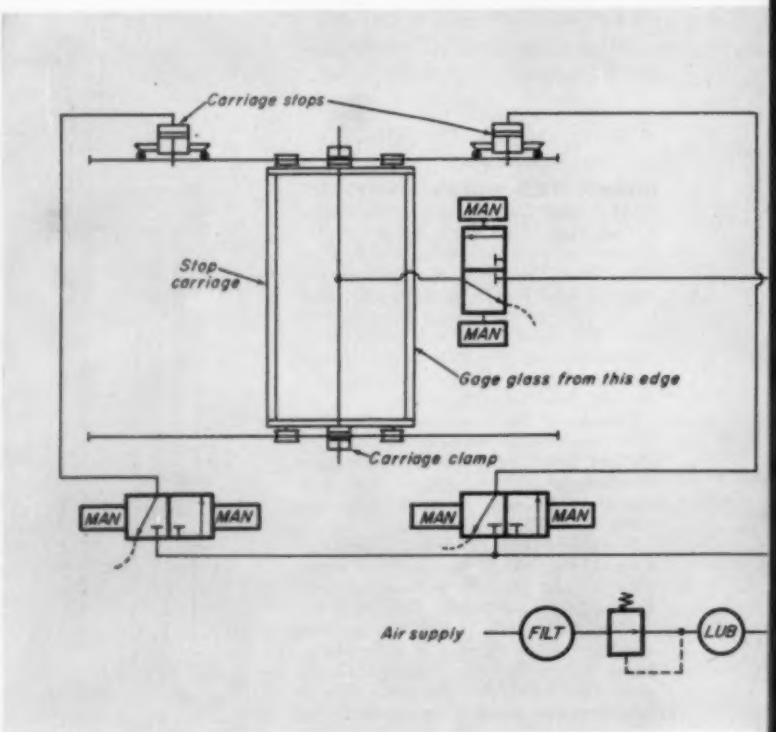
When the end of the boom is 10 inches from the glass, a cam hits a limit switch, energizing solenoid *C* and closing a deceleration valve. Then the air exhausting from the boom cylinder is diverted through a restrictor, cushioning the fall of the boom. A duplicate circuit keeps the boom from slamming when it returns to its up position.

For the actual cutting, an electromagnet locks the boom against the glass. Energized, solenoid *E* opens a valve, starts a small reversible air motor. Geared to a rack running the length of the boom, the motor carrying a glasscutter, drives itself the length of the boom. The glasscutter scores the glass.

At the end of the cut, the motor hits a limit switch, which:

- de-energizes solenoid *E*, to stop the motor
- de-energizes the electromagnet, to release the boom
- energizes solenoid *B*, to raise the boom
- energizes solenoid *G*, which opens a valve that controls a pair of small, single-acting air cylinders. They depress a bar to break the glass.
- energizes solenoid *F* to return the motor

AIRPOWERED GLASS CUTTING MACHINE. Glass rests on inclined felt-padded table, left edge of glass against fence. Cutter has ended its run along the lowered boom-straightedge at right end of table. Boom control cylinder will raise boom gently after breakoff bar knocks off waste glass along the cut.



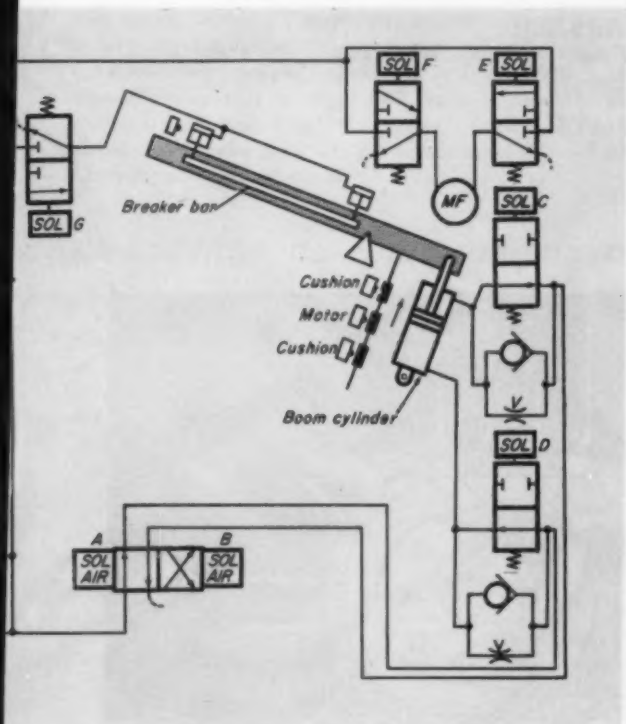
with an air motor

and **PAUL BROWNE**, *R. C. Neal Company, Inc., Buffalo, N. Y.*

• **Clamping Circuit**—This is independent of the cutting circuit. The clamps do not, as one might easily think, clamp the pane of glass that is being cut. The clamps have to do only with the fence or length gage.

A pair of rails run along the edges of the table. The fence, or length stop is a carriage that rolls on the rails. The edge of the table next to the operator is calibrated to make it easy to set the stop.

For cutting a single piece, or for cutting many identical lengths, the operator sets the stop and clamps it pneumatically. The stop carriage carries is own pair of air clamps. For more complicated cutting the operator actuates a pair of stops controlled by air cylinders. He can set the left one for the length of a pane and the right one for the width. Then without further resetting, he is ready to cut panes to length and width just by shuttling the fence back and forth between the stops. ▼▼▼



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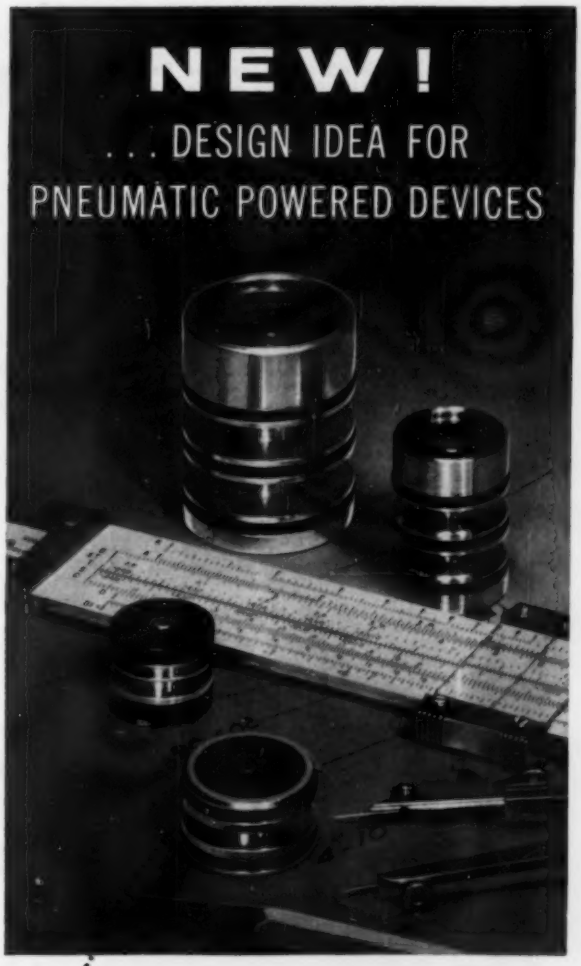

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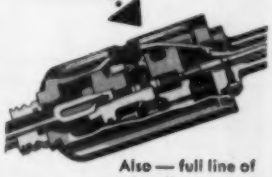

Also — full line of conventionally mounted "Quick-Dump" Valves . . . manual, electric, piloted.

These Humphrey "Quick-Dump" Valves are installed by dropping them into a machined cavity, *inside* the cylinder, manifold, control handle, etc.

They save weight, cut material and component costs, reduce assembly time, speed up production. They eliminate the plumbing, permit installing multiple valves in small space, help simplify, miniaturize and clean up product design.

Choice of 2-way or 3-way, in ⅛" or ¼" sizes, for manual, electric or piloted operation. *Write for bulletin pictured below.*

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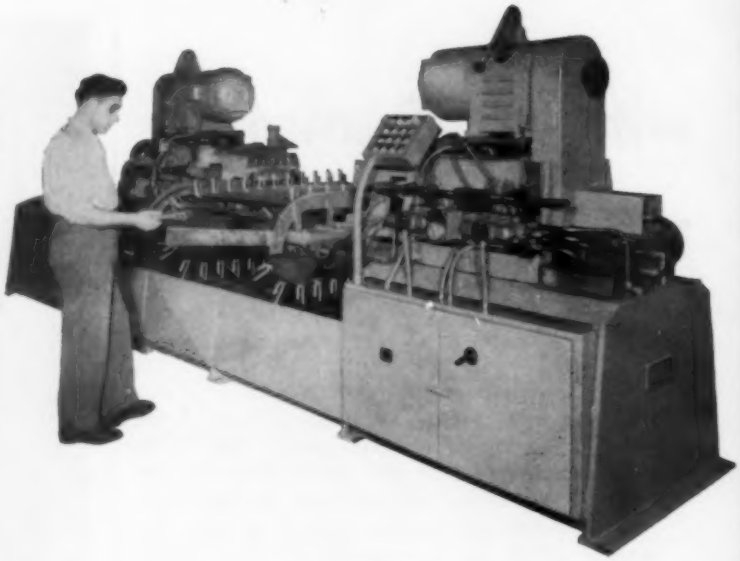
New Home of Humphrey Products

NEW bulletin gives engineering data on Cartridge Valves

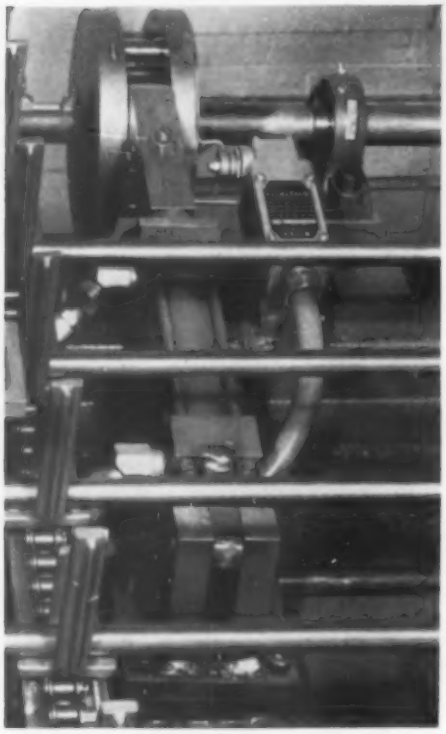
Circle **67** on Time-Saver Card



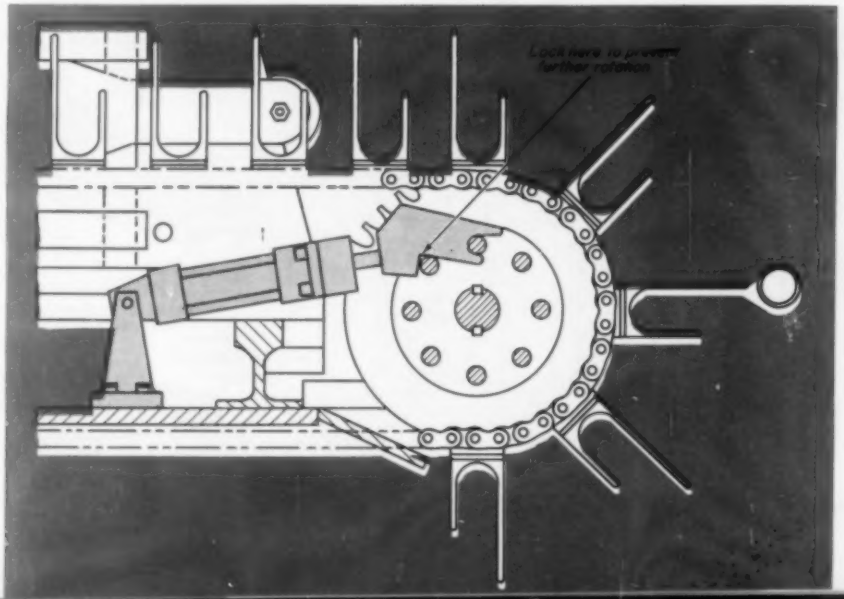
DOUBLE END MACHINE which uses the transfer mechanism has a power head at each end. Each power head has electrically driven spindles for as many as six machining or forming functions. Hydraulic cylinders advance and retract the heads. The hydraulic power unit and electrical control panel are enclosed in the machine's steel base.

Cylinder-actuated index sequences one part/second

• By **WALTER P. HILL**
President Walter P. Hill, Inc., Detroit, Mich.



INDEXING CYLINDER engages bars on the conveyor drive to form a non-overriding index without clutches. The cylinder trips a limit switch which shifts the solenoid controlled directional valves. In this view, 10-ft lengths of electrical conduit are located for clamping, cut to length, dedimpled, and deburred at the rate of 1800 per hour.



ENGAGING MECHANISM is shown at completion of index. The conveyor drive is locked in place because the next bar to be engaged bears against the bottom of the index pawl. Retracting the cylinder engages this bar; extending it indexes the conveyor.

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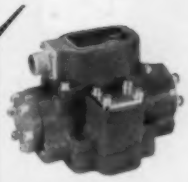

High flow servovalve, valve positioner servo amplifier, (illustrated at left). In addition: integrated hydraulic power packs, mounting manifolds and hardware, electrohydraulic servo-actuators can be provided.

Moog's Industrial Division was established for the purpose of developing commercial applications for electrohydraulic servomechanisms and to serve industry in this new and rapidly growing precision control area. The division offers both integrated electrohydraulic control systems and a complete line of servocomponents.

SEE FACING PAGE FOR ADDITIONAL INFORMATION

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A very important and timely question; ponder awhile..... have any suggestions? Please let us earthmen know. But in the meantime.... a more important question. May we serve you? Custom valve service? The best! Cylinders? Also the best! Expensive? Not necessarily! Call, we'll talk!

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Circle **132** on Time-Saver Card

PROBLEMS & ANSWERS

• By **ELMER F. HEISER,** *Precision Products, Inc., Cleveland, Ohio*

How valves make good impressions

Problem: *We needed a fast, simple way to determine inside contours and dimensions of an unfamiliar valve to establish its performance characteristics.*

Answer: In the custom hydraulic work we do, we frequently have to investigate valve "innards." A strange valve with an unknown porting arrangement was often a problem, because we had to take it apart and measure all inside openings and surfaces.

We used a long straight rod with a right angle tip for probing holes and recesses through the valve body. Using one end as a starting reference point, we reached in, felt the holes or surfaces to be measured, and transposed the dimensions to a layout on paper. When the valve body was dimensioned, we laid the spool on the drawing, and determined valve action by relating the measured ports to the spool surfaces.

This was a tedious process and usually required considerable rechecking of dimensions. The position of small orifice holes was hard to determine exactly, because corrections or allowances had to be made for the probe tip contour. Also it was quite easy to confuse dimensions from the front and back faces of the probe tip.

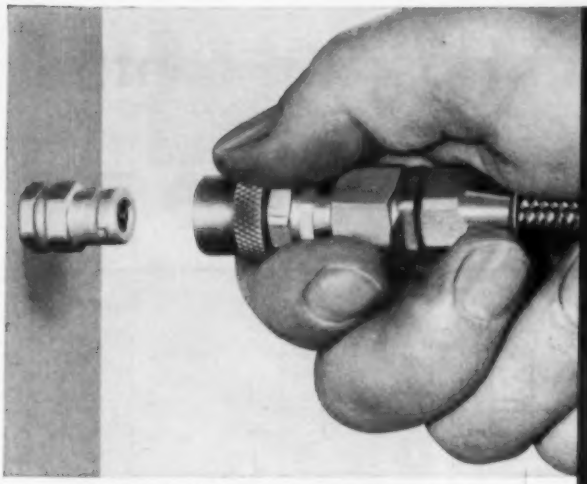
• **Necessity is the Mother**—As an example of our need for a simple, and reasonably accurate means of obtaining valve construction information quickly, a customer stopped in late one afternoon, and brought two standard 4-way valves from his car. He had a machine ready to ship, except it needed two valves with the same porting arrangement. Both of his valves were made by the same manufacturer and appeared identical. One was correct for the job, but the other had "some special porting arrangement" designed for another purpose. He asked if we could rework the special valve so that both would work the same.

Instead of our old method of measuring and layout to determine the construction of the two valves, we used a simpler procedure which has worked well on many occasions since.

Now an important tool for us, and snugly tucked away in a convenient spot in our engineering department, is a box of children's modeling clay. We roll out a strip of clay, lay it on a parallel bar and then press it out in a reasonably straight and even surface. We slip the bar, with the clay, through the valve and press at each end of the bar to force the clay against the inside of the valve body and register an impression along the full length. If necessary we use a tee bar across one end of the parallel to establish a reference surface and also to avoid shifting the bar axially when releasing the impressed clay.

When the bar with the impression is removed, the valve spool is set beside it giving a complete picture of the valve's function. In the case of the two similar valves with different porting arrangements it took only a few minutes, after the valves were taken apart, to determine that simply grinding one spool to change the land widths was all that was needed for identical operation. One hour after he arrived, our customer was on his way and our clay was back in its corner waiting to reveal the innards of other valves. ▼▼▼

Aeroquip's Wide Range Of Self-Sealing Couplings Improves Connections On Any Fluid System



This miniaturized Self-Sealing Coupling on an Aeroquip Teflon Hose Line assures fast, leak-proof connections on the coolant system of an electronic unit.

Aeroquip has developed hundreds of Self-Sealing Couplings for standard and specialized applications. Whatever your requirements, there's an Aeroquip Coupling, or a modification, which will provide better fluid line connections and disconnections.

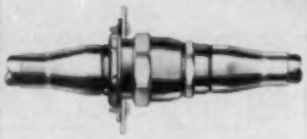
For assistance in solving special problems, Aeroquip's large and long-experienced Engineering Staff is at your service. Mail the coupon below for information.

5600 Series PUSH-PULL Coupling provides quick connections on hydraulic, lube oil, air and water lines. It is available for ⅛" to 1" hose lines at working pressures up to 3000 psi.

5100 Series Threaded Coupling for a wide range of applications where connection under pressure is required. Available for ¼" to 2" hose lines with pressures to 3000 psi., depending on size.

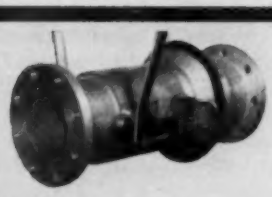
1010 Series Miniaturized Coupling is designed for connections in confined areas. Precision-built, lightweight (.037 lbs.) and compact, it fits ¼" O.D. tube size.

3900 Series PUSH-PULL Coupling combines leak-proof operation with quick, easy connections. Available in sizes up to 1½", it may be used with many low lubricity fluids.



5500 Series Refrigerant Coupling permits precharging and storage of components for remote package units. It is available in sizes from ¼" to 1⅛" O.D. tube sizes.

5400 Series Refrigerant Coupling simplifies assembly line installation of precharged automotive air conditioning systems. Available in O.D. tube sizes from ¼" to 1⅛".



Series 5900 QUICK-LOADER Marine Coupling connects and disconnects quickly to provide fast transfer of liquid cargo without spillage. Sizes for 6" to 12" lines.

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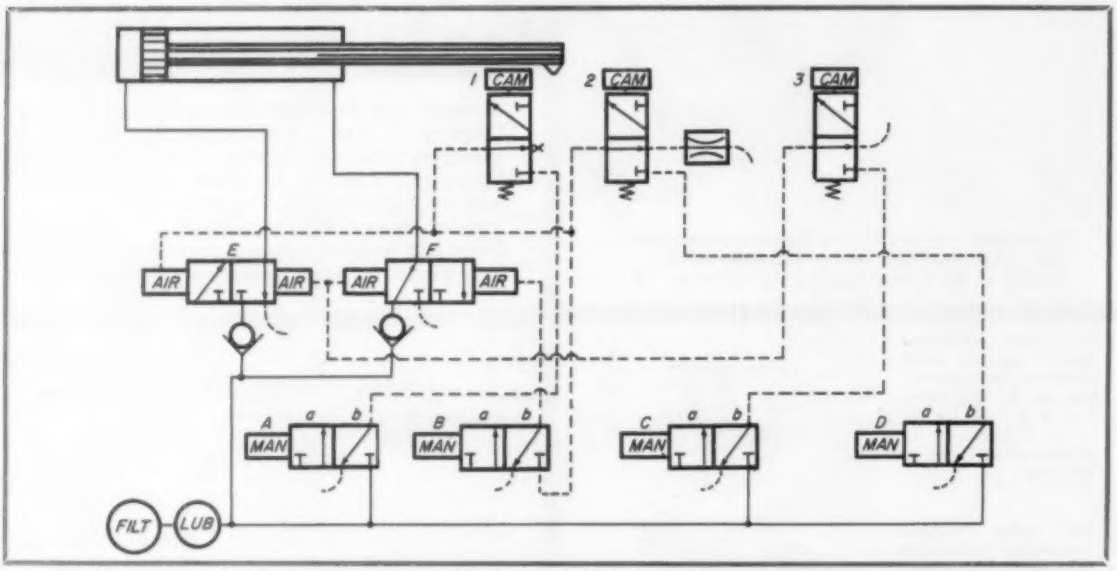
Cylinder position control

• By **W. C. THOMPSON,** *Product Sales Manager, Air Valve and Crown Division Hannifin Company, Div. of Parker-Hannifin Corporation, Des Plaines, Ill.*



HERE'S a versatile control circuit that will stop a cylinder at midstroke or at either end of its stroke, reciprocate it between midstroke and one end, or reciprocate it between extreme ends of its stroke. It uses no limit switches . . . control is all pneumatic.

Two air-pilot operated 3-way valves extend and retract the cylinder. Cam actuated 3-way valves direct air to the control valve pilot ports. Four manually actuated 3-way valves determine whether the cylinder reciprocates through its complete stroke or only half stroke.

Operation I:—To reciprocate between fully retracted and fully extended, valves *A*, *B* and *C* are shifted to position *a*. With the cylinder retracted, valve 1 is actuated. Line pressure shifts valves *E* and *F* to extend the cylinder. The rod moves out until it contacts valve 3. This shifts valves *E* and *F* and retracts the cylinder until it reaches valve 1 and reverses again. The cylinder continues to reciprocate between valves 1 and 3 until it is stopped by shifting valve *A* or *C* as follows.

To stop the rod at valve 1 with valves *A*, *B* and *C* in position *a*, valve *A* is shifted to position *b*. No air can flow to the control valve actuators when valve 1 actuates, so the rod stops at valve 1. To start reciprocating again, valve *A* is shifted to position *a*.

To stop the rod at valve 3 with valves *A*, *B* and *C* in position *a*, valve *C* is shifted to position *b*. No air can flow to the control valve actuators when valve 3 actuates, so the rod stops at valve 3. To start reciprocating again, valve *C* is shifted to position *a*.

Operation II:—To reciprocate between valves 2 and 3, valves *A*, *B*, *C* and *D* are shifted to position *a*. The cylinder moves from valve 1 to valve 3 and reverses as in Condition I above. When the rod contacts valve 2 while retracting, pilot air flows through valves *D* and 2 to the left actuator of valve *E*. Air also flows through valve *B* to the right actuator on valve *F*. The control valves shift and the cylinder extends until it contacts valve 3 and reverses.

To stop the rod at valve 2 with valves *A*, *B*, *C* and *D* in position *a*, valve *B* is shifted to position *b*. When the cylinder rod actuates valve 2 while retracting, air pressure is applied to the pilot on valve *E* only. It shifts, and air enters the blind end of the cylinder. As soon as the pressure balances on both sides of the piston, the rod stops. To start reciprocating between 2 and 3 again, close valve *B*.

To stop the rod at valve 3 with valves *A*, *B*, *C* and *D* in position *a*, valve *C* is shifted to position *b*. No air can flow to the control valve actuators when valve 3 actuates, so the rod stops at valve 3. To start reciprocating again, valve *C* is closed.

To return to Condition I when reciprocating between 2 and 3, valve *D* is shifted to position *b*. Since no pressure is available at valve 2, rod moves on to 1.

Restricting the discharge from valve 2 prevents losing pilot pressure when valve 1 actuates. However, the orifice must be large enough to exhaust this part of the circuit before valve 3 actuates. Minimum travel time between valves 2 and 3 determine size of this orifice. ▼▼▼

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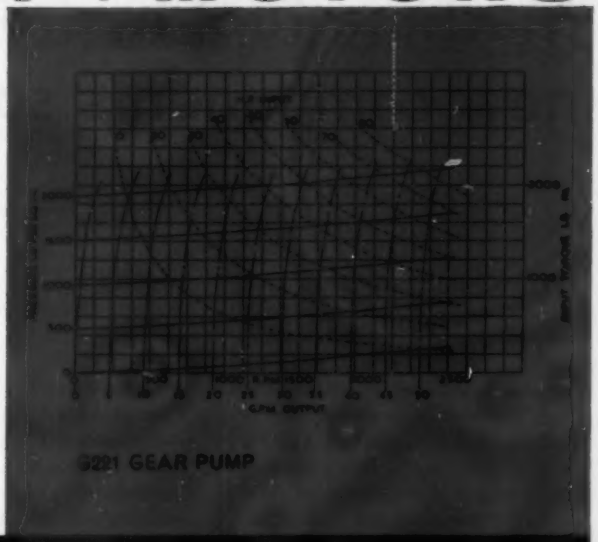
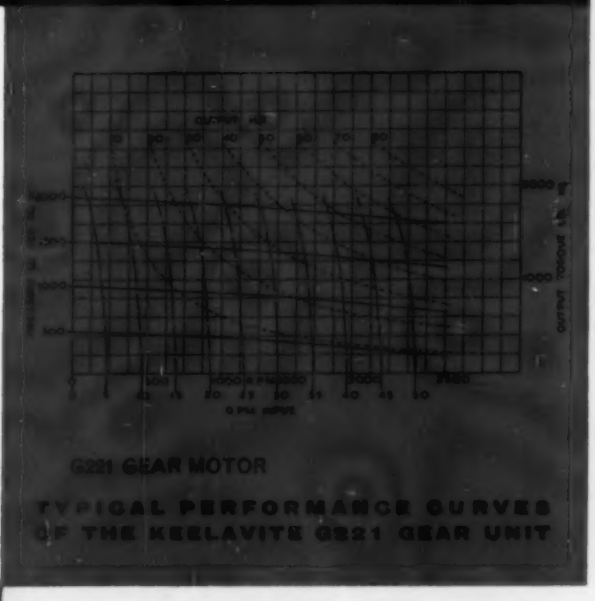


G221 GEAR PUMP



G221 GEAR MOTOR

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SPECIAL REPORT

Machine tool hydraulics . . . new components solve the problems

HYDRAULIC components and systems are keeping pace with new developments in sophisticated machine tools. Inherent characteristics of infinite speed control, high acceleration, and compactness have established hydraulics as *the* way to position tool slides, whether the actuator is a cylinder or fluid motor. Hydraulics also has important advantages for spindle drives where it permits wide speed ranges at constant horsepower.

These capabilities were evident at the 4th Production Machine Tool Hydraulic Conference held in May by Vickers, Inc., Detroit. The 2-day meeting brought together 100 representatives of machine tool builders, users, and hydraulic component manufacturers to discuss previously submitted questions on component needs, circuitry design, and maintenance practices.

• **When to Use a Pressure-Compensated Pump**—Pressure-compensated pumps are finding increased usage on machine tools. In contrast to hi-lo pump arrangements which reduce power requirements by unloading a large volume pump when not needed, pressure-compensated pumps reduce power by delivering only the fluid needed. No excess fluid is passed through a relief valve. Pressure-compensated pumps do not have balanced design like fixed displacement pumps. They usually need no relief valve. Response time of one 5-gpm model at 1200 rpm is .05 sec from zero displacement to full volume. At 1800 rpm it is .10 sec. Cycling speed of the pump is limited to about 60 cpm. Further discussion pointed up the need for efficiency in servo systems where heat is generated by flow through the servo valve. Usually a 2-3000 psi supply pressure is required, so that piston rather than vane units must be selected. This represents a departure from common machine tool practice which has formerly stayed under 1000 psi.

• **Volume Compensated Pump**—This is a very efficient design, but more complex than fixed or pressure-compensated types. Its displacement is varied according to pressure drop across an orifice. It was suggested that at lower volumes, it is probably not as accurate as a pressure-compensated pump.

Though there is a considerable need for pressure-compensated pumps above 5 gpm, Charles Carter of Heald Machine stated there is still a large market for them in the 250-500 psi range.

• **Unloading Valve Differential**—What can be done to reduce the pressure differential of unloading valves? There's a need in some applications for a differential of 10 to 20 psi. M. Graham of Vickers said that pressure differential is a function of the valve's spring rate, pressure drop in the check valve, and override pressure of the relief valve. It is not practical to reduce these, he said. Space limit of the valve is

Continued on page 104

MODERATORS FOR THE HYDRAULIC CONFERENCE representing a machine tool user and builder were Nevin Bean, Staff Technical Assistant, Automatic Transmission Div., Ford Motor Co., and R. C. Montanus, President Springfield Machine Tool Co.

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also a factor, he pointed out. In one type of combination pump, the unloading valve operates at 100 psi under relief valve setting whatever this is adjusted for. In some applications a differential of 10 to 20 psi may *not* be desirable, he stated.

• **Preventive Maintenance and Human Elements**—In a prepared paper, Frank Fiedler of Chevrolet, Buffalo outlined systems used at his plant to keep a "personnel file" on machine operation. A very successful feature of this system is the use of red tags for leaking machines. This identifies leaks as soon as they are detected, and spotlights them until they're fixed. The tags have caused a marked drop in oil consumption from the 112,000 gallons used in 1955 before starting the program.

F. E. Fiedler

• **Fire-Resistant Fluid Performance**—Reporting on General Motors' testing program, Ward Diehl of GM's Technical Center indicated that all types show promise and are being used. Russ Hemeon of the GM Trenton plant described his experience with water glycol fluids for the past five years. He cited a 750-ton die casting machine which has operated 9000 hours and is working well. He stressed the importance of keeping tank temperature below 115 F. Use piping large enough to keep Reynolds Numbers below 2000 for laminar flow. Magnetic plugs are very important to stop internally generated particles which could go through the intake filter. "Five years ago we got 14,000 hours operation with petroleum fluid. Now we are approaching that with fire-resistant fluid," he said. In another application at Fisher Body Div. of GM, William Adamek described good results of water glycol fluid in welding machines. He has also been using water-oil emulsion fluid for several years. Pressure ranges from 500 to 600 psi with vane pumps. Magnetic filters are helping produce the good results. Though there is some tendency for the emulsion to separate, he overcomes it with a manually operated bypass valve which permits recirculating the oil and re-emulsifying it every week. Russ Hemeon emphasized the importance of viscosity checks with water base fluids. He makes them every 15 days on older equipment, every 90 days on new equipment.

Continuing the discussion on fire-resistant fluids and pump life, Art Van Wormer of Vickers emphasized the varieties of fluids on the market and variations in stocks of the same fluid. This compounds the pump design problem, and requires designing for a specific fluid. The differences in water-base fluids was underlined by D. Holloway of Ford who stated that fluid selection must be done with greatest care and not by a purchasing agent on the basis of price alone.

• **Numerical Control—Hydraulics' Place**—Representing Sperry Gyroscope of Canada who design complete custom numerical control systems H. G. Hauck told how the mysteries of numerical control have disappeared since the initial work at Massachusetts Institute of Technology 10 years ago. He outlined hydraulic system operation and showed several outstanding examples on machine tools. Commenting on this paper, Ray Spencer and Ron Render of Vickers cited the main factors in designing a system: cost, speed range, length of travel, accuracy, simplicity, and dynamic performance. In comparing hydraulic and electrical systems, the important advantages of hydraulics are size, weight, speed range, and frequency response. Hydraulic actuators

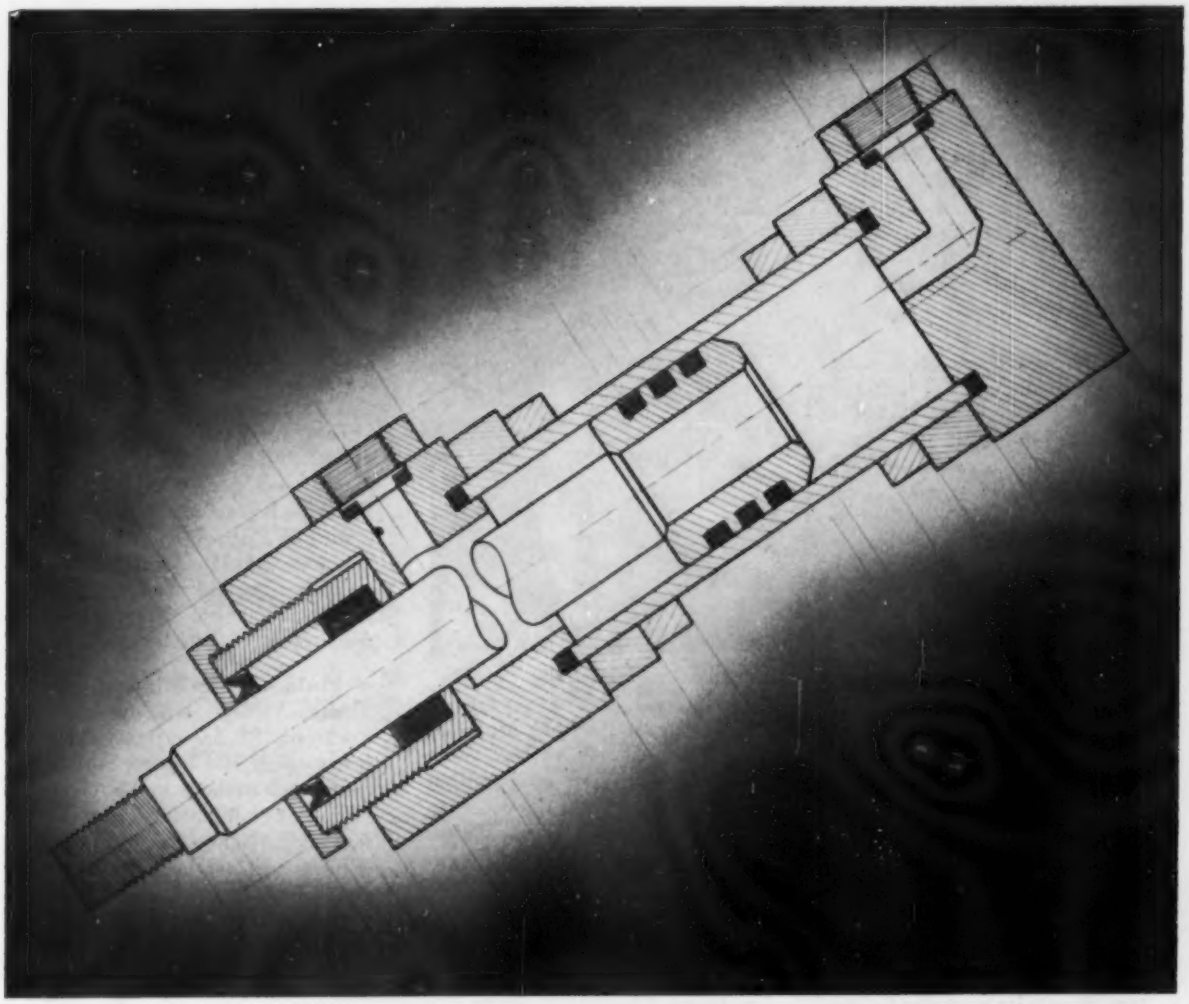
H. G. Hauck

are two to three times smaller and weigh less. This is important where the actuator moves with the machine member. Hydraulics can give a speed range of 4000 rpm to less than 1 rpm, and in many applications has better frequency response than a d-c motor.

• **Pump Pulsation and Turbulent Flow Effects on Servos**—Speaking for Vickers, Ray Spencer said that these have no bad effects on servovalve operation. Pump pulsation frequency is generally so high that the system will not respond. Even if it were a problem, most servo systems have accumulators which would tend to smooth out the pump ripple, he said. Servo valves are designed for operation in the turbulent flow range.

• **Valve Improvements**—Needs for pressure reducing valves with outputs down to 10 psi, improved deceleration valves, higher pressure ratings, and tank pressurization were discussed by Vickers' Don Sweeney who also described new components to meet these needs. He outlined the design requirements to modify a pressure reducing valve from 25-psi minimum to 10-psi minimum. Though this is feasible, he raised the ques-

Continued on page 106



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tions of economics that would have to be answered to justify the development. Needs for a valve of this range were indicated by Robert Guy of GM Detroit Transmission Div. for production testing, and by R. C. Montanus of Springfield Machine for low force clamping.

Improved deceleration valves are now available for 5 to 25-gpm rating. Porting area can be adjusted to give best deceleration characteristics. For lower flow rates, the area is restricted, so that deceleration is over a greater percentage of the stroke.

• **Controlling Surge Pressures**—Several methods were discussed. These included slowing the shifting time of directional valves by using d-c instead of a-c solenoids, or using pilot-operated valves with adjustable chokes. Accumulators are also helpful for absorbing shock, and relief valves can be used to clip off pressure peaks.

• **How Big Should Reservoirs Be?** Jacques Carpenter of Vickers presented general requirements of two to three times pump delivery per minute to allow air out of the oil and solids to sink to the bottom. Reservoirs must also be based on heat rejection, figuring 10 to 20 gallons per rejected horsepower. Frank Mackin of GM Institute emphasized that each design and application should be considered individually. One horsepower loss through a relief valve is equal to 42 BTU/min, he said.

• **Hydraulic Spindle Drives**—This was the subject of a paper delivered by Ben Welte of Colonial-Romulus Div. Colonial Broach & Machine. Horsepower requirements are going up, he said, to allow the use of carbides, and for machining various high temperature alloys. Hydraulic drives are meeting these needs, because they are lighter than electrical drives, and have simple speed controls. He presented design calculations for two applications, one using a fixed displacement pump and variable displacement motor, the other using the opposite arrangement.

Commenting on tool life with hydraulic drives, Horst Schramm has found it's 20% to 30% longer with hydraulic drives than electrical drives.

B. Welte

• **Universal Packing Material**—The search goes on, according to Malcom Everett of Precision Rubber Products. At present there is no compound for all fluids. Viton will probably come closest. Teflon is not the answer, said Dick Leslie of Vickers, because it is not an elastomer and has no "memory."

• **Using Flexible Hose to Reduce Shock, Leakage**—Edward Quincey of Gleason Works gave three reasons why he is using flexible hose on his machines: to reduce vibration, allow for motion, and eliminate leaks due to vibration. Nylon tubing is a new component up for discussion. Robert Guy of GM Detroit Transmission indicated he is using it but staying below the 3/8" size because of heat bending equipment limitations. He said that Nylon tubing is cheaper than steel in sizes to 1/2". The transluscence of Nylon was cited by John Rhoades of General Electric who said it is helpful in checking for pump cavitation.

• **Wide Usage of Welded Tubing**—Approved by the latest revision meeting of JIC, welded tubing is being used extensively on machine tools. Representatives of Cincinnati Milling Machine reported that it is cheaper than seamless and gives the same performance. It is being used by many machine tool builders, they said. (This month's Fluid Power Forum gives more opinions on welded tubing—Ed.)

• **Are Pressures Going Higher?**—Machine tool builders have stayed under 1000 psi because this pressure is adequate for positioning slides, clamping, spindle drives and other machine tool functions. James Yates of GM Detroit Diesel Div. cited the low cost of 1000-psi pumps and their availability. Precision boring machines are operating at 250 psi, he said. Horst Schramm of Rockford Machine mentioned several machines built to use 2500 psi. Difficulties made them go back to 1500 psi.

• **Fluid Conditioning**—Robert Thoren, Vickers field engineer in Rockford, Ill. summarized filtering, cooling, and heating requirements and methods in his paper, "Proper Conditioning of Hydraulic Fluids." Newer designs of power units will not include tank-enclosed inlet filters, but will incorporate an externally mounted filter which has a visible indication of dirt accumulation. He reviewed application rules for full flow, high pressure filtration, bypass filters, and proportional filters. The ideal system has an externally mounted inlet filter to remove large contamination and a micronic filter on the return line for fine filtration.

• **Straight Thread Fittings—When?**—Though they'd like to see general acceptance, component manufacturers are shipping few industrial components with straight-thread ports. Milt Fox of Vickers gave extremely low figures for shipments of valves and pumps with this design. For most types of valves no more than 2% had straight thread ports. Pumps ranged up to 5%. But at least one machine tool builder has taken the big step. Gerard Cormier of Jones and Lamson is using all straight thread fittings in new designs. ▼▼▼

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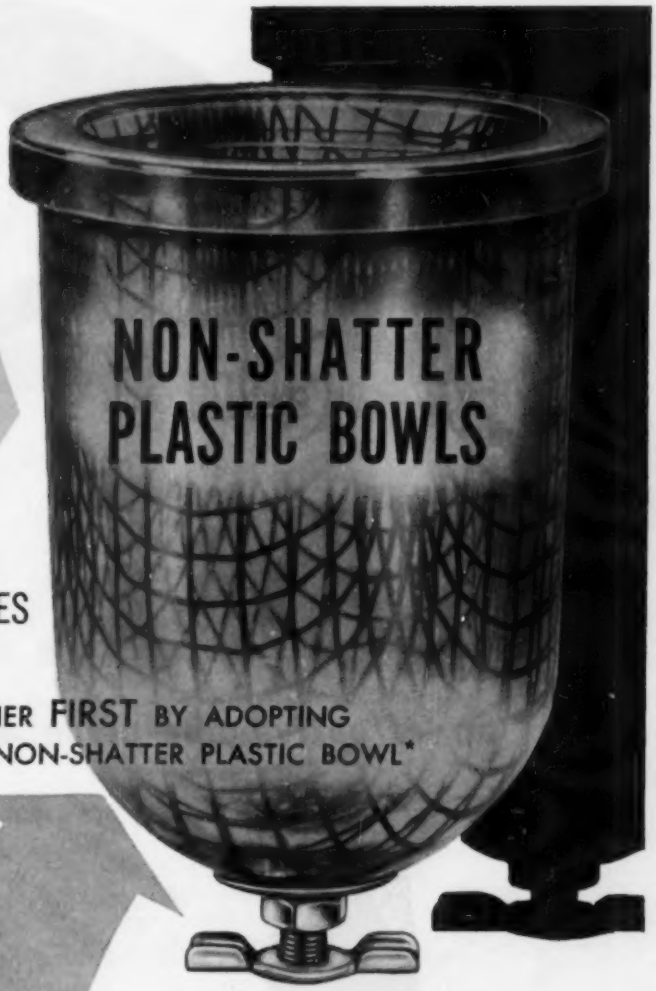

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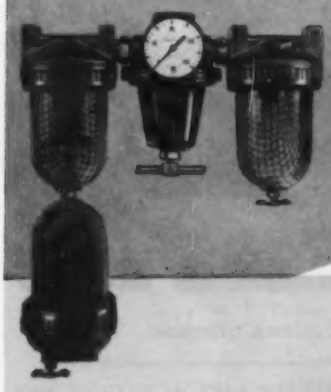

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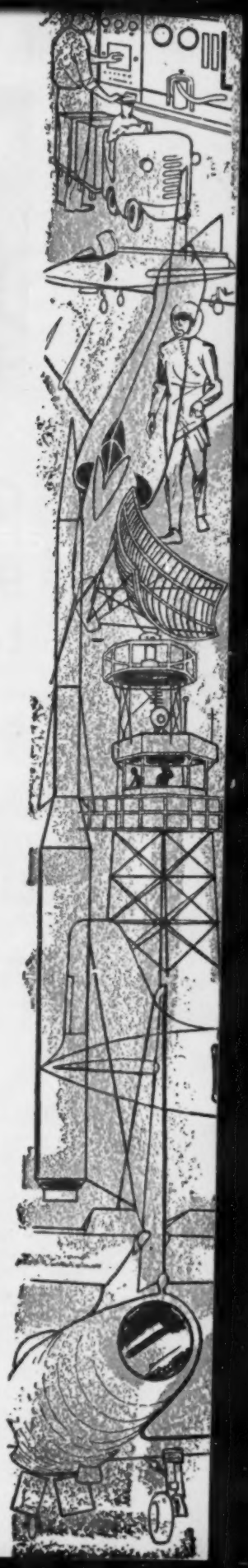
AIRCRAFT SECTION

MISSILES • SPACE VEHICLES • GROUND SUPPORT



GROUND TESTER COMBINES GAS AND FLUID CIRCUITS TO REDUCE ATLAS WEIGHT 110

By H. D. Davis

Hydraulic tester has five subsystems to prepare the Atlas missile for flight. Component and operating tests are made. Tester's reservoir can be pressurized or isolated from the system. Novel oil evacuation chamber adjusts fluid level in missile.

SAE A-6 MEETING 114

Report of the recent Aircraft & Missile Hydraulic & Pneumatic Committee meeting in Miami Beach. News of contamination control and filter standards. Survey of hot gas servos to be started. New pneumatic O-ring specification. Project Hydratoy report.

AVIATION NEWS FROM THE FLUID POWER FIELD 118

AIRCRAFT COMPONENT DATA 122

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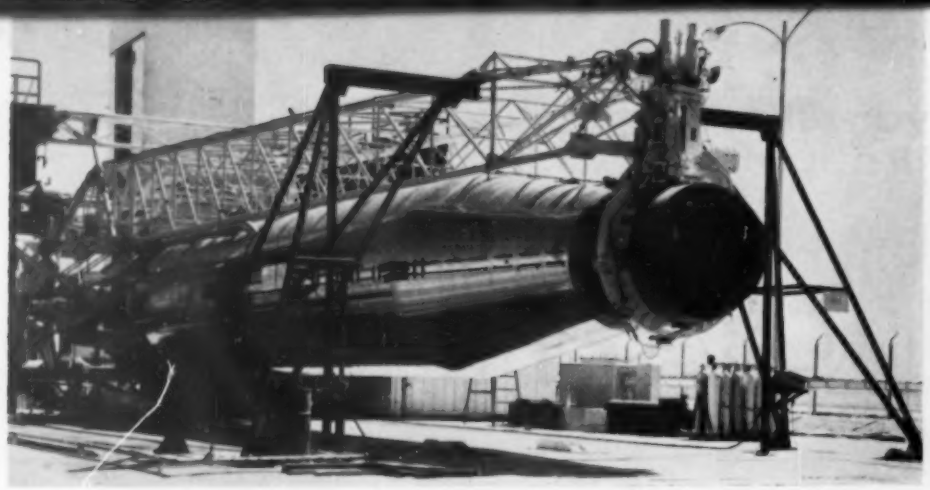


Ground tester combines gas and fluid circuits to reduce Atlas weight

• By **H. D. DAVIS,** *Design Group Engineer, Convair-Astronautics Div., General Dynamics Corp., San Diego, Calif.*

ONLY 1.5% of the hydraulic system's weight in the Atlas missile performs non-flight functions. The ground hydraulic tester for the Atlas has been designed to perform many functions and tests, thus reducing the weight of the non-flight hardware carried on the missile. The ground tester was designed to meet these requirements:

- Fill and bleed the missile hydraulic systems and auxiliary ground support systems.
- Make functional checks of missile hydraulic components and flight control, guidance, and engine control systems.
- Monitor missile pump performance before launch.
- By remote operation, prepare the missile hydraulic system for flight.
- Provide hydraulic power to the missile prior to engine ignition.
- Monitor its own capability to perform the last two items.

These design requirements resulted in the following hydraulic-pneumatic system for testing the missile's first stage.

1 PUMP SYSTEM

The high pressure, main pump is a 23-gpm, variable displacement, axial piston, aircraft type pump which has been modified for use in the tester. The main pump's flow characteristic is set by a fill and bleed requirement during which the flight control and engine actuators are moved fast enough to flush trapped air from the missile system. The response characteristic is set by the need to duplicate the missile pump's dynamic characteristics for flight control system frequency and transient response tests.

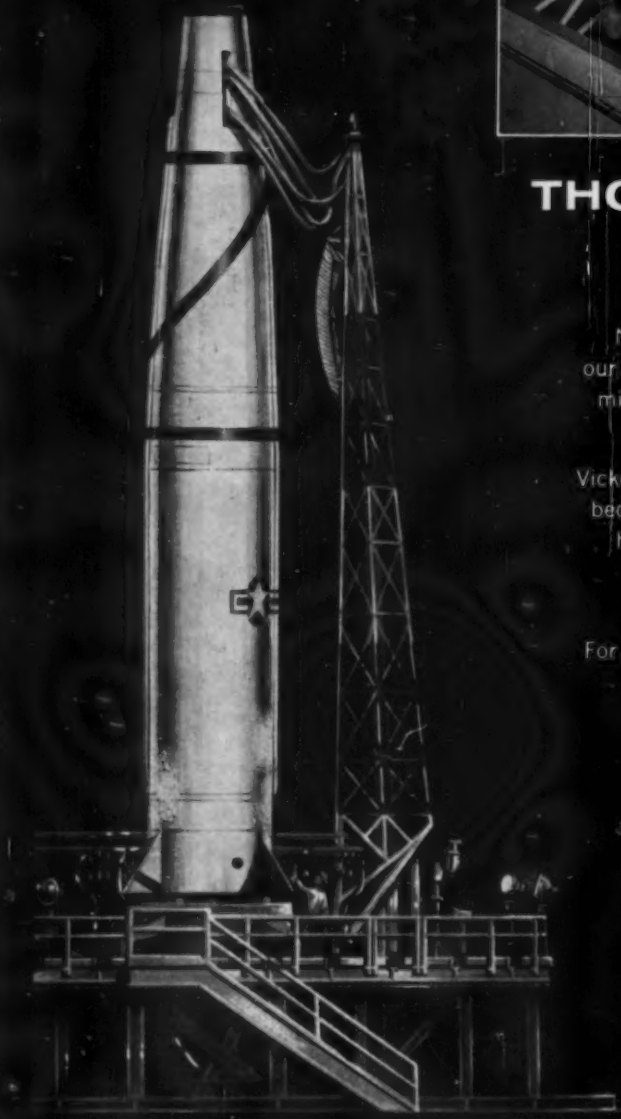
A gear type, fixed displacement, boost pump provides a positive inlet pressure when the tank is closed off from the main pump. The by-pass valve allows the pump to start without a load.

2 RESERVOIR SYSTEM

For pre-flight, stand-by operation, the tank is pneumatically pressurized to maintain a positive head of fluid in the missile and ground systems. This permits controlled drainage from the missile, which is higher than the tester. The TANK SELECTOR valve returns flow from the missile directly to tank, which acts only as a standpipe, through the TANK SHUT-OFF valve. During fill and bleed operations, however, the tank is depressurized to deaerate the fluid quickly. The selector valve is switched to return the fluid through a counterbalance valve and flowmeter to tank. Oil aeration is detected with a sightglass, and the flowmeter is used to measure missile component perform-

Circle 135 →

OPERATIONAL under two flags...



THOR DETERS AGGRESSION

Now rolling from assembly lines in the U.S.A. and being deployed by our ally, Great Britain, is the aggressor-deterring, nuclear-armed THOR missile. Exceptional reliability has been achieved in this IRBM missile through simplicity of design and dependability of components.

Vickers pumps were selected for the vital hydraulic system on the THOR because of their proven reliability record, based upon millions of flight hours in military and commercial aircraft. Vickers built components or complete auxiliary power systems are aboard nearly every missile built in America.

For the future, Vickers is working side by side with contractors, such as Douglas on new and revolutionary APU concepts for missiles and spacecraft of the next generation.

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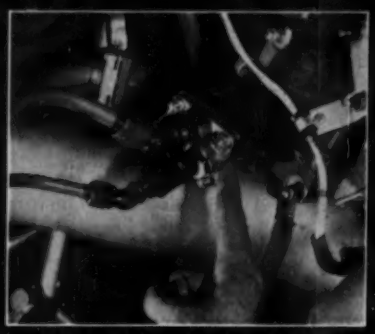

Vickers Main System Hydraulic Pump being installed on THOR

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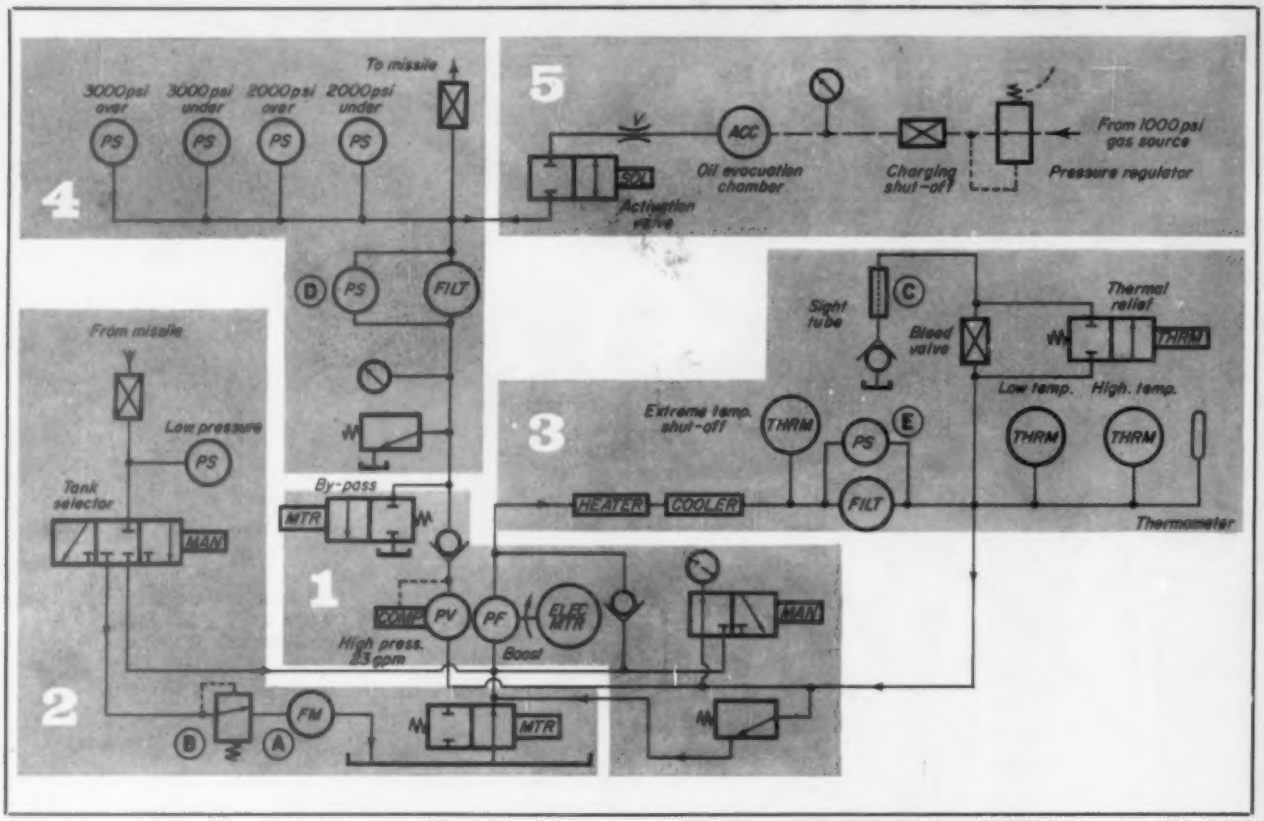
SPERRY RAND CORPORATION

8486



ance. The counterbalance valve creates a back pressure in the missile system when there is no tank pressure. The shut-off valve removes the tank completely from the system just before engine ignition, when the missile tank oil level is adjusted for flight.

3 TEMPERATURE CONTROL AND BLEED SYSTEM

To regulate fluid temperature during cold weather or during high power loss, a thermostatically controlled heater and cooler keep the fluid temperature within the relatively broad range of 35 F to 110 F.

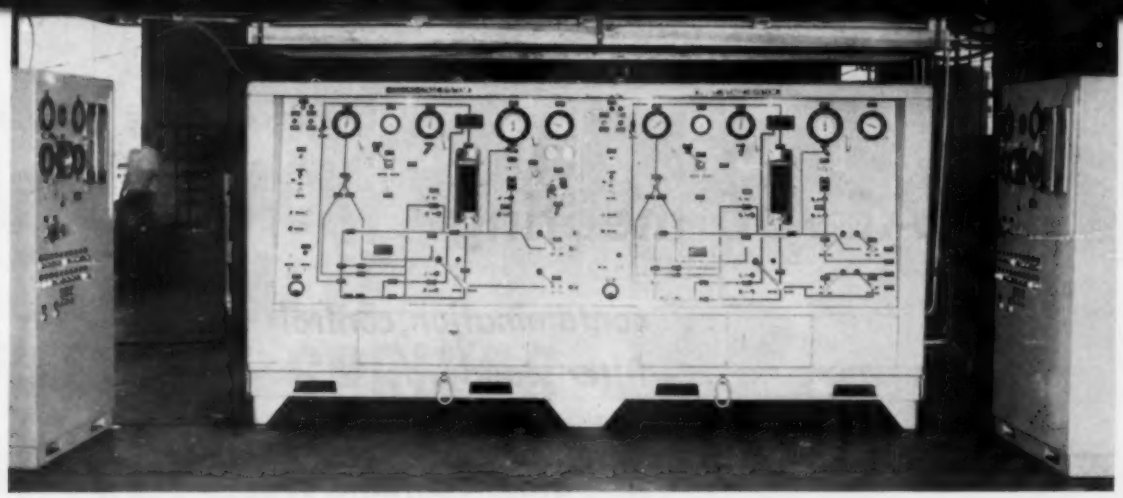
• **Bleed Circuit**—The circuit between the low pressure filter and tank provides thermal relief for the portion of the system between the main and boost pumps. Also, it is the bleed circuit for the tester, missile, and facility lines. Components are located within the tester so the tank and low pressure filters are at high points. Air bleed of the system occurs through automatic return to tank or by manually opening the BLEED valve.

• **Operation of Tester**—For filling and bleeding, high flow flushing is used. The tester's tank is depressurized and flow is to tank through flowmeter (A). The counterbalance valve (B) is set at 35 psi to maintain a fluid column in the missile and the tank shut-off valve is opened to allow circulation through the tank. The pumps are then started and adjusted to 3000 psi. Flight and engine control actuators are exercised by impressing appropriate signals upon their control circuits. The motion of the actuators cause a high rate of flow in the systems. Air is either dissolved in the fluid or is flushed into the tester's tank by the high velocity flow. The bleed circuit is operated manually and bleed fittings, strategically located in the missile, are opened to allow air to escape.

Two methods are used to determine the effectiveness of the bleeding. First, during bleeding, flowmeter (A) and sightglass (C) are observed for bubbles. And secondly, when bleeding is completed, a test is made to determine the amount of residual air remaining in the system. First, tank shut-off valve and tank selector valve are closed to isolate the tester tank and then the missile tank is alternately pressurized and depressurized across a known range. The amount of fluid level drop in the missile tank indicates the compressibility of the fluid air mixture, and indicates the amount of air trapped in the system.

4 HIGH PRESSURE SYSTEM

To prepare the missile for flight, the tester is first set to the preflight, stand-by condition. The pumps are stopped, the ACTIVATION valve is closed, the tank selector valve is set to by-pass the tester tank, and the high pressure by-pass valve and tank shut-off valve are opened. The main circuit relief valve is set at 3800 psi. The pump compensator is adjusted to produce 2000 psi, the tester tank is pressurized to 100 psi and the OIL EVACUATION CHAMBER is precharged to 500 psi. All these parameters, except oil evacuation chamber pressure, are monitored remotely at the launch control



THE GROUND HYDRAULIC SYSTEM TESTER has two separate testing systems. The circuit for testing the second stage is identical to the first stage circuit, which is described here, except for smaller pumping capacity and reduced component sizes. Testing procedure is very nearly the same.

center with an elaborate electrical system.

5 OIL EVACUATION SYSTEM

The OIL EVACUATION CHAMBER is an accumulator-like device which contains a piston separator and is pneumatically charged. It differs, however, from accumulator design because separate O-ring seal glands are used for fluid and gas. The space between the seals is vented to atmosphere. This prevents air from leaking into the fluid system.

During countdown, a semi-automatic sequence is followed. The pumps are started and after a 3-second delay, the high pressure, by-pass valve is closed, supplying the 2000-psi, stand-by pressure to the missile. Hydraulic fluid temperature is continuously monitored during countdown.

Just before missile engine ignition, the oil evacuation sequence is performed. The tank shut-off valve is closed isolating the tank, and the activation valve is opened allowing high pressure fluid to overcome the lower gas pressure in the evacuation chamber, thus filling the chamber with fluid. Limit switches in the chamber signal to the launch control center when it is full. The fluid level in the missile tank is now adjusted to permit thermal expansion of the fluid during flight. In the last phases of the launching process, the missile pumps are started. The tester's last service to the missile is to monitor the missile pump's output pressure to indicate proper functioning. When launching is completed, the tester automatically shuts down and returns to the original stand-by status.

• **Component and Operating Tests**—Functional and leak checks are made with tester. Leak checks are made by visual examination when the system is under pressure. Functional checks of the relief valves are made by raising the pressure high enough to open one of them and at the same time recording its flow versus pressure characteristics, using a pressure gage and flowmeter. A piston friction test of the missile tank is also made by balancing tank gas pressure against fluid return system pressure. The pressure difference necessary to move the tank piston through its stroke is measured. The high response, aircraft type pumps make possible such dynamic checks as flight control system step input response and frequency response.

Low pressure flight control system stiction and closed loop guidance system tests are also made with the tester. For these flight representative tests, the missile hydraulic system is set up to simulate flight configuration, but the tester's pumps are used to duplicate the same pressures and responses as the missile's pumps.

All four filters are wire mesh rated at 10 microns nominal and 25 microns absolute removal. Differential pressure indicators operate panel lights when the filter become loaded.

• **Instrumentation**—Thermal, pressure, and position switches and flowmeters are used to provide local or remote readouts as operations require. Critical valves, and all outlet valves are equipped with position limit switches to indicate proper position during missile countdown. System temperature limits are remotely monitored. Pressure switches monitor the main pump's output limits and also monitor missile pump output pressure just prior to launch. A pressure switch in the tank's pressurization circuit monitors the fluid tank's pressure and is interlocked with a shut-off valve to close it if a regulator fails to control the 1000-psi gas source.

The ground hydraulic system tester, built by Sprague Engineering Co., is very satisfactory. It is relatively complicated by comparison with the usual aircraft hydraulic tester, but this complexity is necessary for servicing and launching the giant Atlas ICBM and for minimizing the airborne hydraulic system's weight. ▼▼▼

SAE A-6 meeting

. . . contamination control
. . . filter standards
. . . hot gas servos
. . . fiberglass containers
. . . pneumatic O-rings

ACTIVITY reports of the contamination control panel and filter standards panel dominated discussion at the beginning of SAE's A-6 Committee meeting in Miami Beach, April 26th to 29th. B. R. Teree, Republic Manufacturing Co., presided at this meeting of the Aircraft & Missile Hydraulic & Pneumatic Systems & Equipment Committee.

One highlight of the contamination control panel meeting was a description of an ultra clean room where components and subsystems are assembled. Walter Kenyon of the Millipore Filter Corp. described this modular, prefabricated, nominal-cost facility.

B. R. Teree

H. D. Davis

• **Contamination Research**—The results of studies into the contamination effects on servovalves were given by George Dick of Cook Research Laboratories and Richard Hollinger of Franklin Institute. Mr. Dick's talk dealt with the overall effect of contaminated oils on valves. For the two valves tested and using artificial contaminants, failure symptoms started at 50 mg/gal concentration. Test system pump failure terminated the test before it was completed when concentration was 130 mg/gal. The tests using two naturally contaminated oils of different contaminant levels revealed no serious degradation of valve operation. Mr. Hollinger's report dealt with the effects on the first stage circuit of the valve, particularly on filters and orifices. Lewis Cook of Industrial Metals Testing Co. presented an interesting and controversial paper on the field use of microscopic contamination measuring. Others expressed a need for a measurement procedure which is more adaptable to field use than the current laboratory type ARP 598.

At the A-6D meeting (Missile Fluid Power Systems), J. F. Hecht, Sr. of Lockheed Missiles and Space Division, presented an excellent paper on contamination aspects of a small, closed hydraulic system. He said that contamination in a closed system appears to reach a constant level after a few hours operation. An interesting paper, "What Do We Know About Red Oil?", was presented by R. F. Connelly. He discussed MIL-H-5606 in general and gave information on the relationship of the oil's properties to contamination.

• **Contamination Limits**—At the A-6D subcommittee and A-6 general committee there has been considerable discussion that contamination limits be established in MIL-H-25475 and MIL-H-5440 specifications. Arbitrary limits in these specifications may not be wise. What may be proper for one system, may be loose or tight for another system. The allowable limits of contamination depends not only on the type and manufacture of the servovalve, but also on the servo loop design and the functional requirements of the system.

After the A-6 meeting, Aviation Advisory Board member H. D. Davis, Convair Astronautics, commented: "Contamination confusion still reigns in the halls of the hydraulics industry, but progress toward understanding is slowly being made. The largest step the industry has made to date is that almost everyone knows that contamination problems exist and each one of us is proceeding very cautiously".

The A-6B Pneumatics Subcommittee meeting was presided over by Aviation Advisory Board member C. H. Cannon of Lockheed Aircraft, Georgia Division. Of numerous items discussed, three significant actions were taken.

• **Pneumatic O-rings**—The committee prepared a new specifi-

Continued on page 116

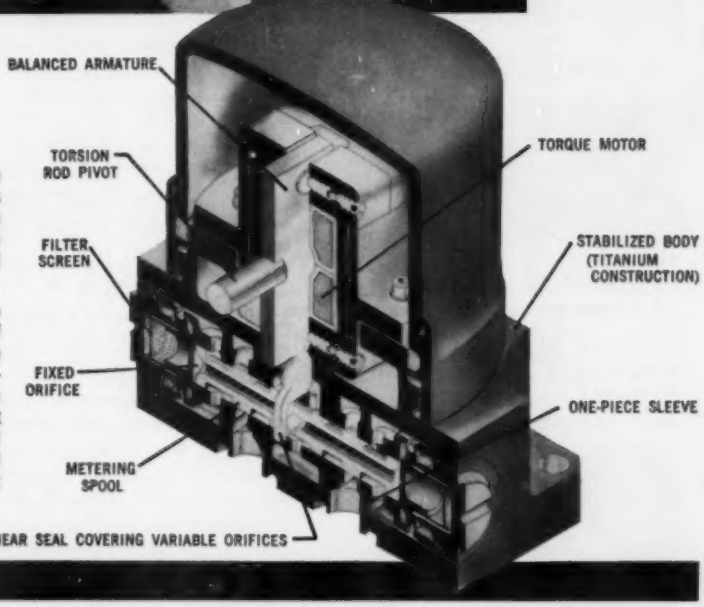
NOW IN PRODUCTION

A FEEDBACK SERVO VALVE WITHOUT SPRINGS OR LEVERS

- *Unity coupled Hydromechanical Feedback*
- *High Null Accuracy*
- *Only 2 moving parts*
- *Large, full opening, shear-seal orifices*

This two-stage, four-way flow control valve is the only one available that provides true positional feedback without springs or levers. The first stage consists of an electrical torque motor and "shear-seal" orifice hydraulic amplifier, while the second or control stage is made up of an accurately matched spool and sleeve arrangement.

Hydromechanical unity feedback relates spool position to torque motor armature position and also nulls out effects of orifice variations due to supply pressure and temperature fluctuations. Flow force reactions are thus substantially reduced and hydraulic centering of pilot position is feasible without spring hysteresis and null shift. Large orifices prevent clogging and silting and high shear forces permit efficient operation even with highly contaminated fluids. Final null adjustments are made electrically by a balancing control at amplifier output stage.



Integrated Control Module Includes Kearfott's Electrohydraulic Servo Valve, Two Rotary Output Shafts, Geared Pump and Pressurized Sump.

TYPICAL CHARACTERISTICS

	Medium Flow (#6103-#6106)	High Flow (#6104)
Rated flow	to 7.5 gpm at 3000 psi valve pressure drop	to 18.0 gpm at 3000 psi valve pressure drop
Hysteresis	3% maximum total rated current	3% maximum total rated current
Supply pressure	300 to 3000 psi	300 to 4000 psi
Proof pressure	4500 psi pressure port 3000 psi return port	6000 psi pressure port 3000 psi return port
Pressure gain	First stage—500 psi per ma minimum with 3000 psi supply	First stage—500 psi per ma minimum with 3000 psi supply
Load pressure gain	8500 psi per ma minimum with 3000 psi supply	10,000 psi per ma minimum with 3000 psi supply
Temperature	−65°F to +275°F	−65°F to +275°F

	Medium Flow (#6103-#6106) (% of rated current)	High Flow (#6104)
Maximum Null Shift Temperature Change per 100°F	1%	1%
Supply Pressure Variation ±	2%	2%
Quiescent Current Change 20%	1%	1%
Weight	12 ounces	16 ounces

TORQUE MOTOR: Note: 6103 & 6106 identical with exception of torque motor characteristics.

	Valve #6103	Valve #6106
Input Power	300 Milliwatts	64 Milliwatts
Rated Current	± 10 ma	± 8 ma
DC Coil Resistance (other motors also available)	3000 ohms/coil	1000 ohms/coil

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cation to cover the development of O-rings for use in 3000-psi pneumatic systems at —65 F to 275 F. It is SAE document AIR No. 79. It has been prepared to fill a long needed requirement for a purely pneumatic O-ring. Standard rings presently used in pneumatic systems were developed for hydraulic systems. Since these standard O-rings are not satisfactory, many companies have been specifying special O-rings, from which the need for a new standard developed. Preparation of the document was by the G-4 Elastic Seals

E. T. Raymond

C. H. Cannon

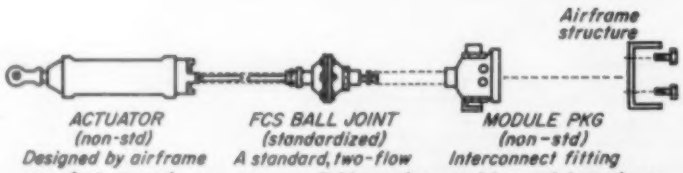
Committee, of which E. N. Cunningham of Precision Rubber Products Corp. is chairman. F. A. Lewis of Linear Incorporated was given the assignment of preparing an appendix to the document listing acceptance standards for high reliability O-rings.

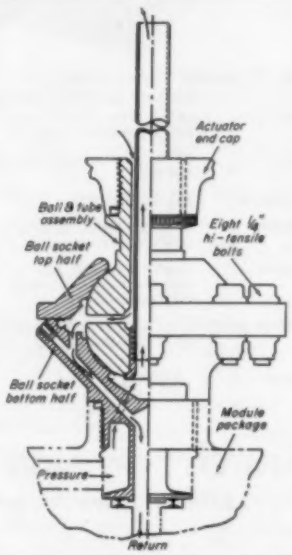
• **Project Hydratoy**—The modular hydraulic components development program continued at Chance Vought Aircraft, Aeronautics Division, under a Navy Bureau of Aeronautics contract. Grady Gilder, Jr. gave a progress report on the design study, which can have far-reaching effects. Fluid carrying structural (FCS) ball joints eliminate hose or coiled tubing as methods of getting fluid into hydraulic actuators which move relative to the airframe. The FCS ball joint simplifies assembly and makes standardization feasible by separating ball joint design from actuator design. Standardization would mean no one aircraft manufacturer would have to absorb the tooling costs of the close tolerance FCS ball joints. They would be purchased like a standard part from component vendors. The ball joint design is available for licensing by Chance Vought Aircraft, Inc.

• **Hot Gas Panel**—In April, 1959, a hot gas servo systems panel was established, with E. T. Raymond of Boeing Aero Space Division as chairman. Planning and preliminary work has been completed by this panel, and at this meeting it was decided to accelerate and expand its activities. To coordinate and foster development of hot gas systems a state-of-the art document will be prepared. A survey of the industry will be made to obtain pertinent data on hot gas systems. The panel plans to prepare as soon as possible specifications covering components for hot gas systems.

• **Fiberglass Containers**—Failures of pneumatic fiberglass containers on military aircraft have been reported recently. The reason for the failures has not been established. But H. E. Heigis of Kidde Aero Space Division thought deterioration results from exposure to moisture from condensation. He suggests more severe humidity tests. Jack R. Snyder of MacDonnell Aircraft wrote in that fiberglass containers had been removed from one model of military aircraft at the Service's request. Ben Mettee reported the Bureau of Weapons is not approving the use of fiberglass containers until investigations and tests are completed by the Air Force. Jack Prete of WAAD wrote in that they are restricting the use of fiberglass pneumatic containers to 300 flight hours or 24 months, whichever comes sooner.

• **Filter Panel**—J. W. Ruttle, Jr. of The Martin Co. reported an


Airframe structure
ACTUATOR (non-std) Designed by airframe manufacturer and sized to a specific job.
FCS BALL JOINT (standardized) A standard, two-flow passage, fluid carrying, structural universal ball joint. Airframe manufacturer need only cut downstream feed tube to length.
MODULE PKG (non-std) Interconnect fitting and/or module package designed by the airframe manufacturer to fit a specific location.



FLUID CARRYING STRUCTURAL BALL JOINT is proposed as a standard type by Project Hydratoy. Hydraulic fluid temperature range is —40 F to 450 F with 4000 psi working pressure and 6000 psi surges. Another design operating condition is a 6-degree angular sweep of the actuator.

interesting discussion at the Filter Standards Panel meeting. It covered design and test requirements and potential difficulties in qualifying filter assemblies for government agencies in the following areas: by-pass relief valve setting; dirt-holding capacity; differential pressure indicator functioning and location; filter pressure drop at low temperatures and its relation to proper functioning of the pressure drop indicator.

• **New Filter Spec**—A new specification was announced for a 15-micron, absolute hydraulic filter (MIL-F-8815) to be used with missile and type II aircraft systems.

At the A-6D meeting a survey (A-6D5) presented by Conrad Cooke of The Martin Co., Baltimore, showed that industry is conducting vibration tests and using techniques beyond the requirements of MIL-E-5272-C (Amend 1) for most missiles and rockets. Functional tests are often performed at the same time as vibrational tests. Random vibrational environments are usually included in addition to sinusoidal frequencies.

Another survey (A-6D4), presented by W. Seamone of the Applied Physics Laboratory of Johns Hopkins University, compiled industry recommendations for short term exposure of hydraulic components in a high temperature environment. The conclusion is that type II (275 F) components are being used at higher temperatures for a short time.

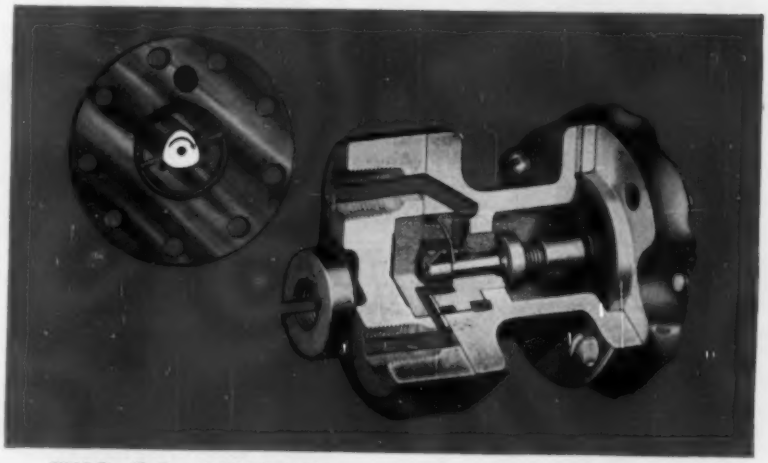
Several interesting reports were presented at A-6. One was a progress report on the development of an extended duration, 1200-F torque motor by J. L. Poggie of Republic Aviation and J. R. Farron of Bendix Aviation, Development Research Laboratory Division. Charles C. Smith of Lockheed Aircraft reported on aircraft hydraulic system tests at 600 F.

• **Next Meeting**—The A-6 committee, its A,B,C, and D subcommittees, and various panels will meet in San Francisco during the week of October 17th. ▼▼▼

YESTERDAY'S PIONEER . . . TODAY'S LEADER

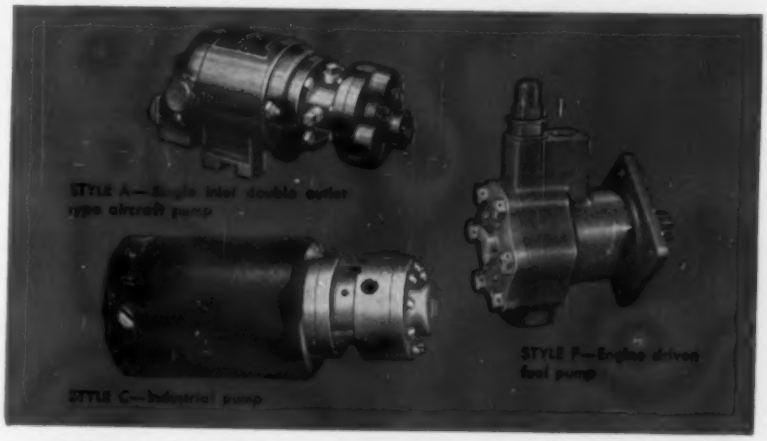
WELDON / FLUID METERING PUMPS

Positive Displacement Rotor Type. For Industrial Applications, Aircraft Anti-Icing and Aircraft Fuel.



IT'S SO SIMPLE!

The rotation of the rotor draws the fluid in through two passages, filling the cavities formed by the three lobes of the rotor. This fluid is sealed within these small cavities until it is forced through the two outlet holes by the floating blades. The flow may be kept uniformly divided through two outlet ports, or may be combined internally for passage through a single port.



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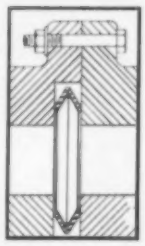

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The Apex Metallic Seal is fully qualified for incorporation in all static applications. Surface finishes to 100 RMS may be sealed with very low flange loads. Write for Catalog 1000.

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MODEL	20-1	20-2	20-3	20-4
Stroke (in.)	±.006	±.007	±.008	±.015
Output Radius (in.)	.650	.593	.750	.906
Midposition Force (lb.)	2.5	5.0	8.0	13.0
Hysteresis (%)	2	2	2	2
Resonant Frequency (CPS)	940	790	580	400
Max. Power Req'd (Watts)	1.6	2.65	3.1	5.2
Weight (oz.)	2.8	5.8	9.0	19.5

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AVIATION NEWS

from the fluid power field

McCarthy named Parker v.-pres. & controller

Warner B. McCarthy has been appointed vice-president and controller of Parker Aircraft Co., Los Angeles. Parker Aircraft is a division of Parker-Hannifin Corp., Cleveland, Ohio. Responsibilities of his new position include all accounting and treasury functions, operating controls, and the supervision of government contracts.

United Aircraft Products appoints regional manager

Russell Britain as been appointed regional manager of the Midwest sales area by Robert Hueffed, general sales manager, United Aircraft Products, Inc., Dayton, Ohio. Britain has been with UPA Contractural Engineering since 1957, concentrating on heat exchanger and oil tank sales for aircraft and missiles.

Hueffed also named two additional salesman to assist Britain. They will be assigned to East Texas and Southeastern States areas.

Britain

Josalle

Aeroquip creates sales manager post

Appointment of T. J. Josalle to the newly created post of general sales manager was announced by Don T. McKone, vice-president and general manager of Aeroquip Corp., Marman Division, Los Angeles. Josalle was formerly aircraft sales manager of the Division. He will be responsible for world-wide aircraft and missile sales, as well as industrial and commercial sales.

Cornelius installs dynamometers

The Cornelius Co., Aero Division, Minneapolis, Minn., has installed new large dynamometers and hydraulic test stands. The dynamometers are for testing the recently introduced line of miniaturized hydraulic motors and pumps at loads up to 100 hp. They will show whether desired torque and power is being produced. Cornelius will use the test stands to test latest types of hydraulic fluids in pumps and motors and to duplicate environmental conditions at temperatures to −65 F, altitudes to 60,000 ft, and various shock and vibration conditions.

Jack & Heintz buys aircraft couplings line

The couplings line of Roto-Lock Couplings, Inc., South Gate, Calif., has been bought by Jack & Heintz, Inc., Cleveland, Ohio. The quick-connect hose couplings are for aircraft and missile systems, and industrial applications. Inventory and tooling will be moved to Cleveland. Jack & Heintz will continue engineering and development, to expand the couplings line.

Paul-Munroe receives GSE contract

A $200,000 contract for building hydraulic GSE for Atlas missile launching sites has been awarded the Paul-Munroe Hydraulics, Bell Gardens, Calif. The con-

Continued on page 120

HOW ACIPCO HELPS CANADAIR KEEP 'EM FLYING

HYDRAULIC CYLINDER JACKS USED IN AIRCRAFT CONSTRUCTION AND MAINTENANCE EMPLOY ACIPCO CENTRIFUGALLY SPUN TUBING

The 10-ton hydraulic wing jack shown here is one of a number of different capacity jacks utilized by Canadair in its aircraft plants near Montreal. The hydraulic cylinders of these jacks are ACIPCO centrifugally spun tubing . . . and the manufacturers were supplied with Type 4130 normalized and tempered tubing in a variety of sizes ranging from 6½" O.D. to 11½" O.D.

"You may like to know, your material met our rigid specifications in every respect," wrote the manufacturer to ACIPCO, "and its excellent quality is such that the cylinders will render satisfactory, trouble-free service. The exceptional machinability of your tubing proved a definite asset in the manufacture of our cylinders."

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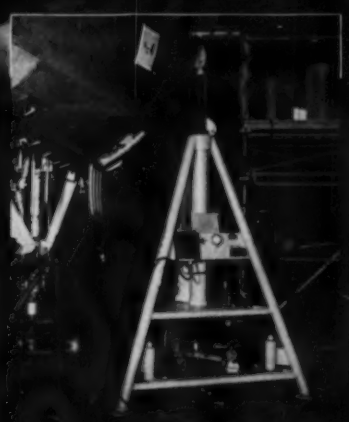


VERSATILE ACIPCO CENTRIFUGALLY SPUN STEEL TUBES

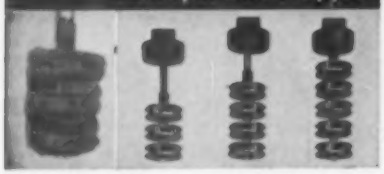
SIZE RANGES: Lengths up to 40 feet have been produced to meet modern machinery requirements. O.D.'s from 2.25" to 50"; wall thicknesses from .25" to 4".

ANALYSES: All alloy grades in steel and cast iron, including heat and corrosion resistant stainless steels, plain carbon steel and special non-standard analyses.

FINISHES: As cast, rough machined, or finish machined, including honing. Complete welding and machine shop facilities are available.

Circle **76** on Time-Saver Card

NEW MAGNETIC CLEANER for HYDRAULIC POWER UNITS the Kebby Tank-Trapper



★ Powerful Alnico V Magnets
★ Highest Active Area
★ Engineered for Power Concentration
★ Easy to Apply
★ Low Priced . . . Quick Delivery
★ No Moving Parts . . . No Maintenance

MEETS NEW J.I.C. HYDRAULIC STANDARDS

The Kebby Tank-Trapper is specifically designed to complete the protection of hydraulic systems against damage by iron particles worn off moving parts of various components. It picks up material missed by the filter and prevents premature filter loading. Expensive shut downs and service calls are drastically reduced. Write for Bulletin 1-500-59.

THE KEBBY COMPANY
2320 Custer Avenue Rockford, Illinois
Designers and Manufacturers of Magnetic Devices, Kebby Mite and Filtray Coolant Cleaners

AVIATION NEWS

from the fluid power field

tract let by Western Gear Corp. calls for construction of nine hydraulically actuated lifting and locking systems to control 800,000-lb overhead doors. Scheduled for completion in mid-1960, the doors are part of a 22 million dollar construction program at Warren AFB, Cheyenne, Wyoming.

Scholz, O'Rourke & Rumford get Vickers posts

The Aero Hydraulics Division of Vickers, Inc. has announced the appointment of Wally V. Scholz as district representative for the San Francisco area. He is a registered professional engineer in California. His headquarters will be the new district sales office located at 900 North San Antonio Rd., Los Altos, Calif. Western regional sales manager A. L. Stone announced the appointment of Donald G. O'Rourke as sales manager for the Los Angeles area. At the same time Stone appointed Edward D. Rumford as an application engineer for the division.

Gas generator powers ejection capsule

A dual gas generator system is used in the pre-ejection system of escape capsules for the Convair B-58 supersonic jet bomber, the Hustler. The capsules, being developed by the Stanley Aviation Corp., Denver, Colorado, are designed to allow high altitude ejection and to provide flotation in event of water landing. The gas generators, two in a single package, provide energy to perform pre-ejection functions. Each dual generator weighs 3½ lbs and was developed by McCormick Selph Associates, Hollister, Calif. The crewman is braced in his seat, completely encased, and ready for ejection in from .5 to .8 sec from the time of generator activation.

Vinson Engineering names sales engineer

Vinson Engineering & Sales Co., Van Nuys, Calif., has appointed Gordon Rusk as sales engineer. W. A. Goodman, sales manager, said Gordon's experience includes design experience with tranducers and valves.

Hydraulic Research forms Two Divisions

Hydraulic Research and Manufacturing Co., Burbank, Calif., has formed two separate divisions for servo control systems and standard hydraulic and pneumatic valves. The announcement was made by C. C. Martenson, president. The two divisions are designated Servo Control Division and Standard Valve Division. Ivan J. Umbarger, formerly chief engineer, will be general manager of the Standard Valve Division. Sam Garcia will be production manager and Carl Stephens, chief engineer. Louis C. Garday, formerly with Convair, Astronautics, has been appointed chief engineer of the Servo Control Division.

LIGHT AS A FEATHER
The Fisher in-line pressure switch
15 amps capacity
Tamperproof adjustment from 50 to 3500 psi
Weighs only 3 ounces
$14.75 LIST
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Manufacturers representatives' inquiries invited
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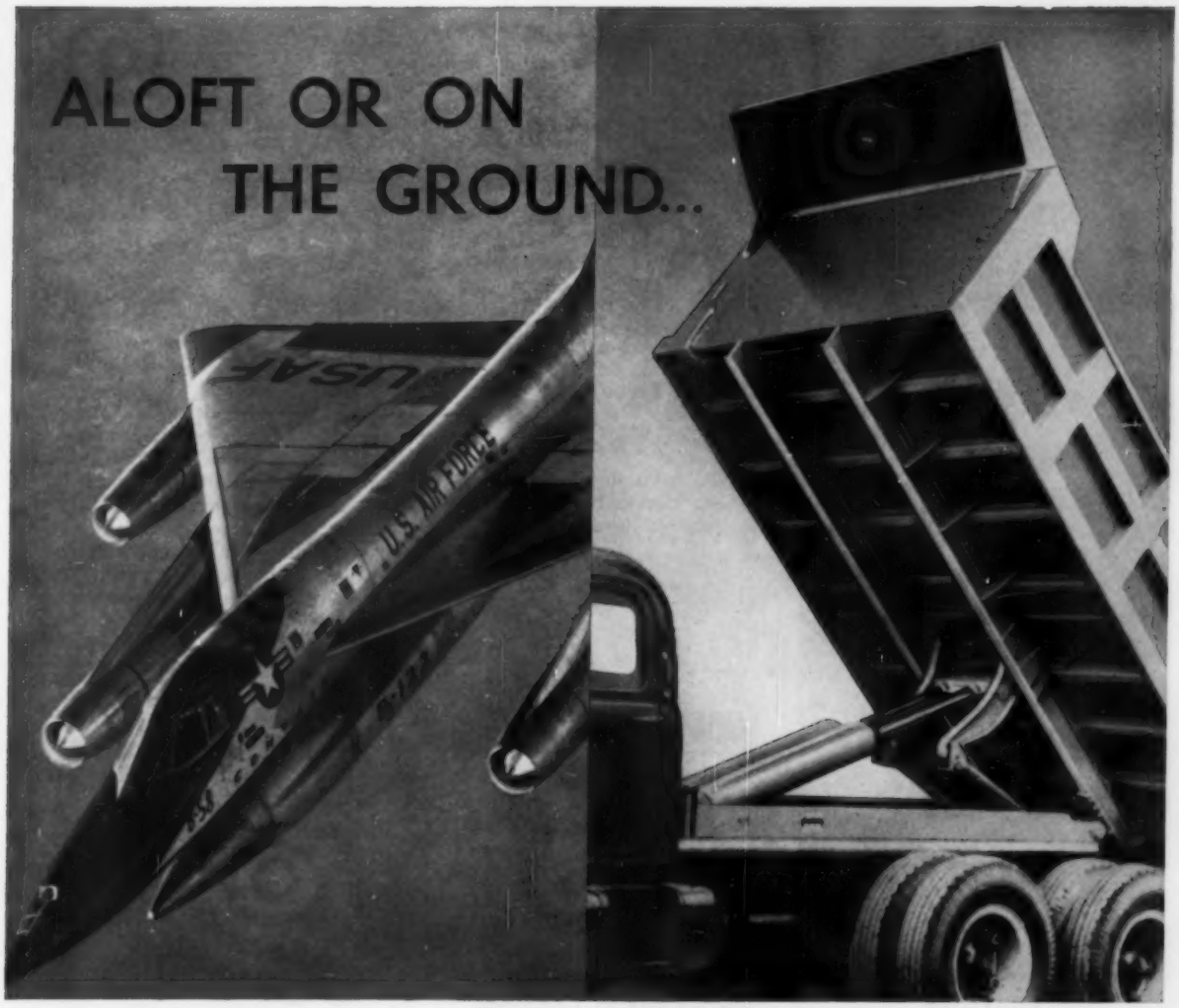
Circle **47** on Time-Saver Card



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Koppers solves diverse and difficult sealing problems.

Modern supersonic jets and dump trucks—as dissimilar as they appear—both depend on Koppers Sealing Rings for efficient hydraulic system operation. Koppers *Predictable Performance* Sealing Rings are used in a wide variety of applications . . . engineered to satisfy each requirement of both hydraulic and pneumatic sealing.

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A Koppers Sealing Ring is applied to a B-58 actuator.

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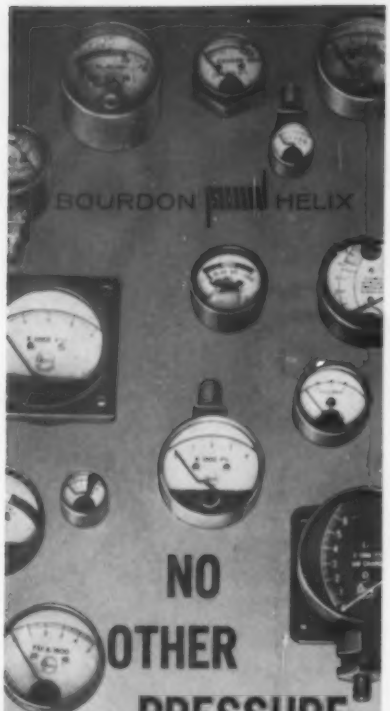

NO OTHER PRESSURE GAUGE OFFERS SO MUCH

Rugged beyond all mil specs, these light weight Bourdon-Helix gauges maintain constant accuracy under the most severe environments.

Essentially custom-made to individual specifications, Bourdon-Helix designs have been successfully created for over 1800 special applications, any one of which may be a solution to your gauge problem.

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Glassco instrument company

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Circle **57** on Time-Saver Card

AIRCRAFT COMPONENT DATA

Tandem Servovalves & Actuators

. . . for flight control

HP324100 and HP325100 have 1-piece sleeve, 1-piece spool. Reproduce identical flow in two

hydraulic systems. Synchronization unaltered during service. Servovalves have low dynamic plunger forces. Rectangular orifices for linear flow. For 4000-psi, 275-F systems.—*Hydra-Power Corp., New Rochelle, N. Y.*

Circle **500** on Time-Saver Card

Quick-Opening Couplings

. . . covered in brochure

Brochure also covers cryogenics systems, bellows-type expansion joints, and plastic structures.—*Uni-Flex Mfg. & Engineering, Inc., Los Angeles, Calif.*

Circle **501** on Time-Saver Card

Explosive-Actuated Valve & Reservoir

. . . can be reused

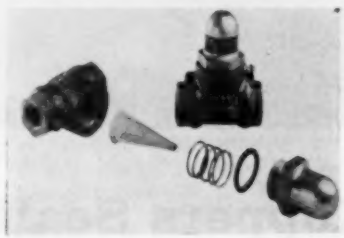
For primary or emergency use in aircraft and missiles. Valve squib, exploded electrically, generates rapidly-expanding gas. Gas forces plunger forward, to shear disc or membrane section. Stored, compressed gas is released from container, and goes to mechanism to be actuated. The two gases can't mix. Valve normally mounted on reservoir. After minor modifications, valve mounts practically anywhere in plumbing system can be reused by recharging reservoir. and replacing valve squib and shear disc.—*Kidde Aero-Space Div., Walter Kidde & Co., Inc., Belleville, N. J.*

Circle **502** on Time-Saver Card

100-Mesh Strainer

. . . for control valves

Brass screen prevents chips and flakes from entering hydraulic valves. When connected before and



after valve, it eliminates major cause of valve malfunction. Specially designed inlet and outlet ports provide continuous flow. Can be cleaned without removing from line. Temperature range is —70 F to 275 F with pressures to 3000 psi.—*Gound Systems, Inc., El Monte, Calif.*

Circle **503** on Time-Saver Card

Differential Pressure Indicators

. . . have seamless bellows

Bellows of 300 Series are heliarc welded to components. Suited to inaccessible locations. In aluminum, brass, or steel. Pressure range is 0-50" H_2O to 400 psi. Ambient temperature limits are —30 and 175 F. 0.5-cu-in displace-

Continued on page 124

PARKER VITON O-RINGS
where to buy & get more information

ALABAMA
Birmingham: Owen-Richard, Inc. FA 2-3611
Mobile: Bearings & Trans. Sply. Co. HE 8-3591
ARIZONA
Phoenix: Air-Draulics Co. AL 4-4703
Phoenix: Arrow Valve Corp. AL 4-7294
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Inglewood: Aero Bolt & Screw Co. OR 8-3931
Oakland: Nor-Cal Supply Co. LO 9-3121
Glendale: Robert B. Porter Co. CH 5-7631
Hayward: Robert B. Porter Co. JE 7-0300
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Indianapolis: Avels Sales & Eng. Co. ME 9-1326
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Cedar Rapids: Globe Mach. & Supply EM 5-6911
Davenport: Globe Mach. & Supply 2-7151
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Spencer: Globe Mach. & Supply 1786
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KENTUCKY
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Louisville: General Rubber & Supply ME 5-2606
LOUISIANA
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New Orleans: Dixie Bearings, Inc. MA 6363
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MASSACHUSETTS
Boston 10: Irving B. Moore Corp. HU 2-7565
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Kalamazoo: Depatie Fluid Power FI 4-1830
Detroit 1: J. N. Fauver Co. TE 2-4115
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Detroit 39: Roger Zatkoff Co., Inc. KE 2-2121
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Joplin: Industrial Equip. Co. MA 4-1400
St. Louis 3: Sealtite Corp. CE 1-7724
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Omaha: Wilson-Wylie Dist. Co. AT 9873
NEW JERSEY
Hasbrouck Hts.: C. E. Conover & Co. AT 8-3800
Jersey City: Louis H. Hein Co. HE 5-1965
NEW YORK
Woodside: Durham Aircraft Services AS 4-9000
Alden: Hercules Packing Corp. MU 2300
Schenectady 8: Staver Hydraulic Co. FR 7-2204
Waverly: Staver Hydraulic Co. TU 2-2751
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Charlotte: Dixie Bearings, Inc. ED 2-2151
Greensboro: Dixie Bearings, Inc. BR 4-4686
OHIO
Cleveland: Cleveland Ball Bearing Co. HE 1-8866
Cincinnati 13: J. N. Fauver Co. TW 1-8400
Akron 8: B. W. Rogers Co. PO 2-0251
Cleveland 14: B. W. Rogers Co. SU 1-2530
Columbus: Williams & Co. AX 4-1623
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Oklahoma City: Ind. Gskt. & Pack. Co. CE 6-4321
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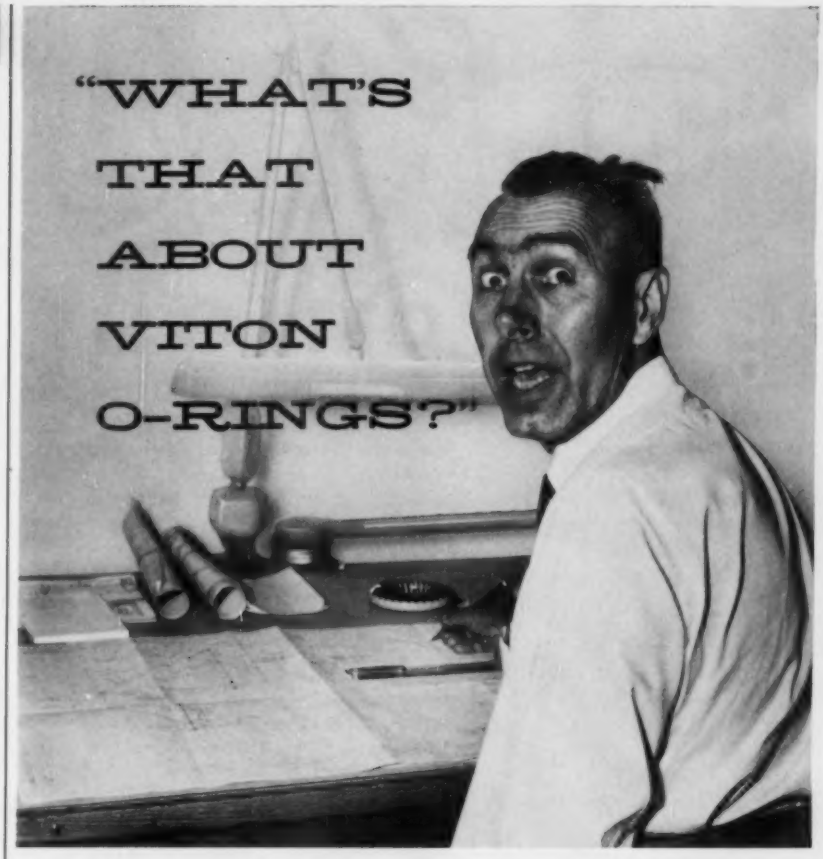

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1. All AN (ARP) sizes as *standards*—no charge for tooling, faster delivery, *proved* and *tested* quality
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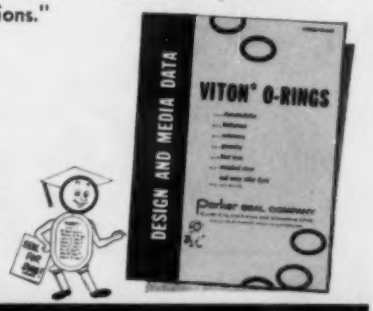
Parker Seal Company's nation-wide staff of sales engineers and distributors are eager to serve you. If you would like a copy of our Viton O-Ring Handbook call the distributor nearest you (see list at left) or write direct to factory.



Parker SEAL COMPANY
Culver City, California and Cleveland, Ohio
A DIVISION OF PARKER-HANNIFIN CORPORATION

Circle **103** on Time-Saver Card

2 NEW! STRATOFLEX HYDRAULIC COUPLINGS

Thanks to non-metallic seals, the new Stratoflex all-purpose couplings guarantee a positive self-sealing unit when connected or disconnected. When the two halves are connected, the valves open automatically to assure maximum flow, with a minimum of pressure drop.

Stratoflex Self-Sealing Couplings are available in three designs: wing nut, hex nut and knurl sleeve, with NPTF Pipe Thread or SAE "O"-Ring Boss Thread, in sizes ranging from ¼" to 1¼".

Stratoflex Quick-Disconnect Couplings are furnished in NPTF Pipe Thread and SAE "O"-Ring Boss Thread, with a size range from ¼" to 1".

For complete information on Stratoflex Hydraulic Couplings, write for Stratoflex Bulletin S-6 immediately.

SFB-9

STRATOFLEX Inc.

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Circle **122** on Time-Saver Card

AIRCRAFT COMPONENT DATA

ment for full scale. ¾" SPT mounting, ¼" connection.—*Industrial Instrument Corp., Austin, Texas.*

Circle **504** on Time-Saver Card

Hydraulic Brake Master Cylinder . . . is power assisted

Operates as power-assisted unit with 3000-psi inlet pressure. Low or zero inlet pressure as master cylinder. Compression-type cylinder

has 1 cu. in. displacement at 1.875" stroke. Installed length is 14.47". Weighs 2.12 lb. Adjustable assist cutoff. Relief valve limits brake pressure. Assist ratio of power-on to power-off is 6:1.—*Gladden Products Corp., Glendale, Calif.*

Circle **505** on Time-Saver Card

Differential Relief Valve . . . for high-pressure gases

Model A-90157 holds helium and other gases for long periods without leakage. Cracks, flows, and reseats with minimum pressure loss. At 6500 psi ±100-psi crack, valve

reseats at 6300 psi min. Handles 6500 psi. Flows 10 cfm helium. Temperature range is —65 to 275 F. Inlet is ½"; outlet, ¾". Connections are AND, IPS, or Aminco. —*Vinson Engineering & Sales Corp., Van Nuys, Calif.*

Circle **506** on Time-Saver Card

Self-Sealing Coupling . . . for liquids & gases

Fast, safe connections where positive, foolproof locking is mandatory. Connection verified by audible click. Indicator pins protrude externally when coupling is locked. Indicator pin position can be determined manually. Connect and disconnect with single, one-hand movement. Connect to line pressures to 60 psi. Will not disconnect accidentally even under forces from 20 g's. Various end fittings.—*Aeroquip Corp., Jackson, Michigan.*

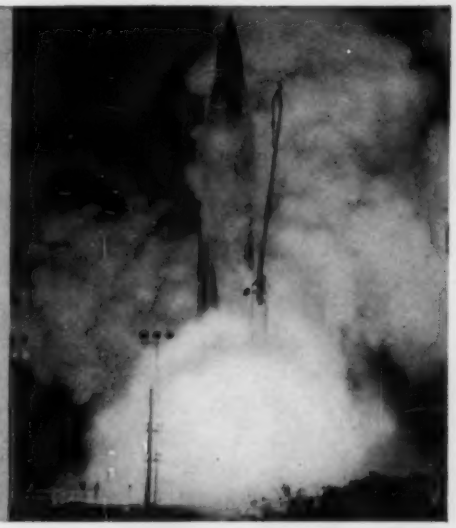
Circle **507** on Time-Saver Card

Missile & Spacecraft Power Systems . . . covered in booklet

Hot gas motor system has integrated hot-gas motor and hydraulic pump, hot gas generator with solid propellant, and pressurized bootstrap reservoir. Hot gas servo system has electrically controlled hot gas servovalve. Linear opposed piston actuators provide rotary output torque. Integral feedback transducers. Hot gas is metered through symmetrical pair of upstream orifices, into actuator cylinders. Electrical signals vary downstream orifice areas, to make unequal cylinder pressures. Presures act against opposed pistons in cylinder. to position airborne missle surface controls or missle exhaust nozzles. Silver-zinc battery systems and flywheel systems. For spacecraft, hydrogen-oxygen system offers significant weight advantage. Combination cryogenic-positive displacement engine is efficient at all power levels on hydrogen. Power generation and equipment cooling in one system. Bulletin A-5239, 11 pages, discusses systems' concepts, development, and advantages. Curves. Cutaway drawings.—*Aero Hydraulics Div., Vickers, Inc., Div. Sperry Rand Corp., Torrance, Calif. & Detroit, Mich.*

Circle **508** on Time-Saver Card

ON EVERY ATLAS COUNTDOWN RMC-LINDSAY PRESSURE GAUGES ARE CONSULTED

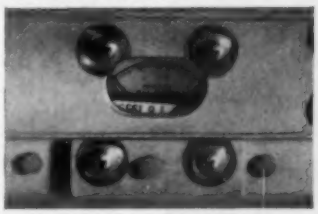


Used for Readout of Gas Pre-Charge in Hydraulic System Accumulators

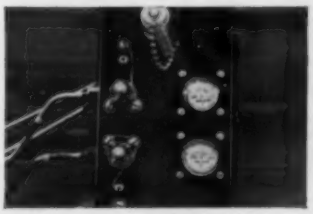
Complete reliability, freedom from jamming even under severe overloads, resistance to shock and vibration, the ability to keep functioning accurately whether setting in the desert sun or subjected to extreme cold . . . these are some of the reasons you will find 6 RMC-Lindsay High Pressure Gauges on each Convair Atlas.

These gauges must withstand shock tests of 100Gs. They are checked for accuracy in vibration tests ranging from 10 to 2,000cps at 35Gs and at ambient temperatures from −65°F to +275°F. *There is no linkage, no gear train to disintegrate or to cause pointer vibration. The indicating pointer is attached directly to the end of the helical bourdon coil.*

RMC Gauges are built to the most exacting laboratory standards for accurate performance under the most rigorous conditions encountered in modern industry, in jet aviation, in astronautics.



RMC Gauge for the booster engine hydraulic system accumulator is flush mounted on the booster engine compartment for easy reading from the outside.



RMC gauges used on sustainer of engine hydraulic system are mounted on the side of the missile fuel tank beneath a maintenance access panel.

If you have a high pressure gauge problem let RMC engineers work with you in its solution. Write, wire or phone:

ROCHESTER MFG. CO. OF CALIFORNIA
1401-C S. Shamrock Avenue, Monrovia, California

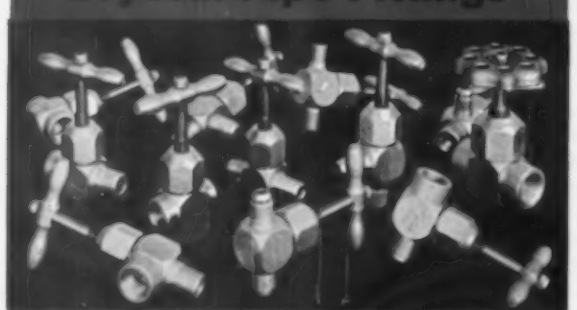
ROCHESTER MANUFACTURING CO., INC.
209-C Rockwood Street, Rochester 10, N. Y.

RMC
LINDSAY PRESSURE GAUGES

NEW RMC PLANT IN MONROVIA

The new RMC Monrovia, California plant has been specifically designed for full scale plant production of precision instruments without sacrificing laboratory production standards.

Circle **112** on Time-Saver Card



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all from L&L

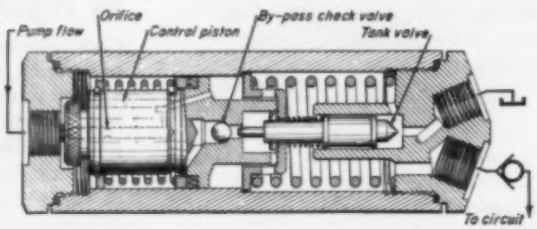
Circle 80 on Time-Saver Card

FLUID POWER PATENTS

Starting Valve

To eliminate high starting torque on a pump drive motor, this valve unloads pump flow to tank until the flow increases to a value set by the valve. At this point pump flow goes to the circuit and the tank port closes.

• **Operation**—Pump flow enters the valve through the port on the left and flows through the calibrated orifice in the control piston and into the spring chamber. The ball check prevents flow around the



piston. The tank port and the port leading to the circuit open into the spring chamber. Since the tank line offers the least resistance, pump flow returns to tank.

When flow through the valve reaches a set value, pressure drop across the calibrated orifice in the control piston is sufficient to move the piston right against the spring force. The tank valve closes and fluid flows to the circuit.

As pump flow increases further, the piston continues to move right until the extension on the tank valve spool moves the bypass check valve off its seat. Pump flow then bypasses the piston and flows to the circuit with very little resistance.

As flow through the valve decreases, the control piston moves left. It first closes the bypass valve and then opens the tank valve.

U. S. Patent No. 2,855,945 *by Jean Louis Gratzmuller, Paris, France.*

Pilot Relief Valve

The valve is designed for in-line mounting in a hydraulic system. At pressures below the setting of the valve, fluid enters through the inlet port, flows through the venturi and outlet port to the system.

An orifice through the valve piston allows pressure to build up in the cavity behind the piston. A port in the valve body connects this cavity with the pilot valve. System pressure is also applied to the piston at the valve's outlet port. Spring force holds the valve

BLAMING COIL BURN-OUT ON THE SOLENOID? THEN TAKE A CLOSER LOOK AT THE **VALVE!**

SPOOL and POPPET Valves bind and stick as dirt collects... overload solenoid and cause coil burn-out.

"SHEAR SEAL" Valves are not sensitive to dirt... always retain solenoid power margin.

D.C. SOLENOID "SHEAR SEAL" VALVES 0 to 10,000 P. S. I.

A.C. SOLENOID "SHEAR SEAL" VALVES 0 to 10,000 P. S. I.

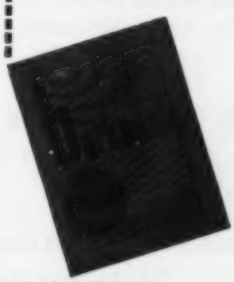
EXPLOSION PROOF A.C. and D.C.

SOLENOID "SHEAR SEAL" VALVES 0 TO 10,000 P. S. I.

SPOOLS and POPPETS leak... can't compensate for normal wear.

"SHEAR SEAL" Valves stay leakproof... a spring takes up the normal wear.

ASK FOR CATALOG V-59-60



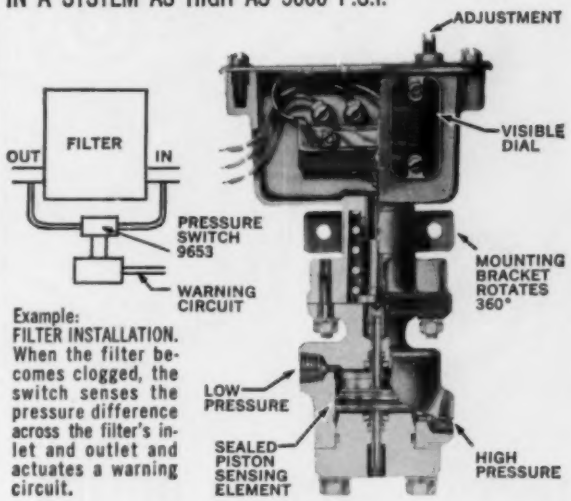
CONTROL VALVE DIVISION

barksdale valves

5125 ALCOA AVENUE • LOS ANGELES 58 • CALIFORNIA

NEW PRESSURE DIFFERENCE SWITCH

SENSES A LOW DIFFERENCE OF 10 P.S.I. EVEN IN A SYSTEM AS HIGH AS 5000 P.S.I.



Example: FILTER INSTALLATION. When the filter becomes clogged, the switch senses the pressure difference across the filter's inlet and outlet and actuates a warning circuit.

The new Model 9653 is constructed to sense a difference from 5 P.S.I. to 140 P.S.I. between two pressures. A sealed piston sensing element actuates an electric circuit on increasing or decreasing of a predetermined pressure difference. It is applicable to oil systems ranging from 50 P.S.I. to 6000 P.S.I. working pressure. A high proof pressure rating of 9000 P.S.I. is your protection against damage from surges and shock loads. Field setting is simplified by means of an external adjustment screw and visible dial.

WE BUILD IN	WE DON'T USE
RUGGEDNESS Can take surges— (High proof pressures) Continuous operation— (Millions of cycles) No sticking— (in dirty fluid)	 **LINKAGES & BEARINGS** Which wear quickly—(cause settings to drift and switch to fail).
LABOR & MATERIAL SAVINGS No return drain piping— (Sealed piston) Mounts where convenient (Operates in any position, Not sensitive to vibration)	 **UNSEALED PISTONS** Which add to your installation cost (return piping). Are critical to dirt— (pistons get stuck).

Ask for new pressure switch handbook and catalog '59-'60

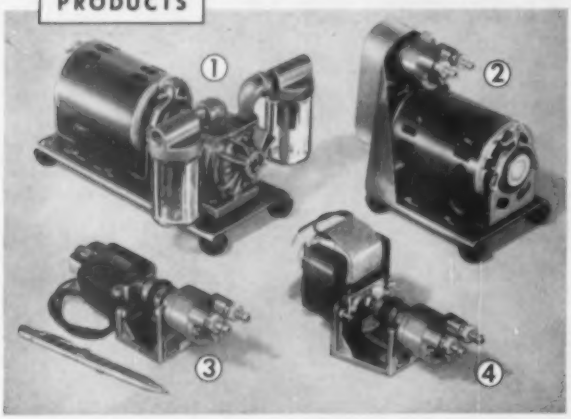
PRESSURE SWITCH DIVISION

barksdale valves

5125 ALCOA AVENUE • LOS ANGELES 58 • CALIFORNIA

ROTARY AIR
GAST
PRODUCTS

NEW for 1960



TWO TYPES OF MINIATURE OIL-LESS

GAST Rotary Vane VACUUM PUMPS and AIR COMPRESSORS

1. Model 1030-V110-206 Vac. Pump, 1/20 h.p. Up to 1 c.f.m.; to 15" vac.
2. Model 0330-V112-206 split phase 1/20 h.p. motor, .48 c.f.m. Up to 20" vac. or 15 p.s.i.g.
3. Model 0330-V102A-151 series wound motor. Up to .67 c.f.m. To 20" vac. or 10 p.s.i.g.
4. Model 0330-V110-202 shaded pole motor. Up to .35 c.f.m. To 20" vac. or 10 p.s.i.g.
5. (Below) Model 0630-P103 Compressor, up to .6 c.f.m. To 25 p.s.i.g. or 24" vac.

FOR ORIGINAL EQUIPMENT APPLICATIONS ON CONTROLS, INSTRUMENTS, BUSINESS MACHINES, LAB EQUIPMENT

Now — where space is very limited — you can provide moderate vacuum or pressure with one of these two types (3 series) of Gast semi-miniature Air Pumps.

They run entirely without oil. Carbon vanes lubricate themselves, producing a completely oil-free air blast or exhaust. Rotary design is simple, trouble-free and positive in air displacement.

The largest Model 1030 (1 above) delivers up to 1 c.f.m. running open at 3450 r.p.m. Model 0630 (5 below) has identical exterior, delivers up to .6 c.f.m. Smaller type 0330 (2, 3, 4 above) is shown with a choice of motors to suit various pump applications, both a.c. and d.c. With a rotor diameter smaller than a penny, Model 0330 produces up to .67 c.f.m. (open) at 6000 r.p.m.!

These "semi-miniatures" may solve a problem for you — investigate today!

WRITE TODAY FOR BULLETIN M-OVP.

GAST MANUFACTURING CORP., P.O. Box 117-D
Benton Harbor, Michigan

See Catalog in Sweet's Design File

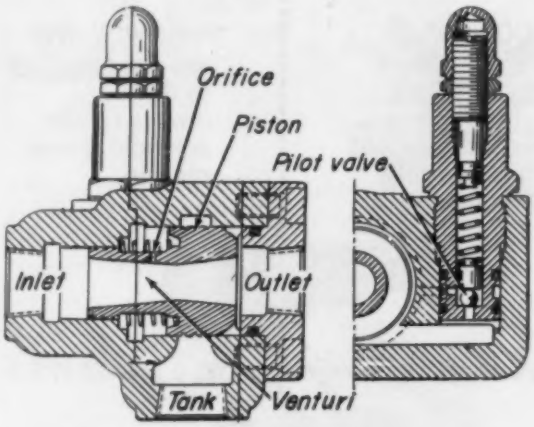
GAST ROTARY
• AIR MOTORS TO 7 H.P.
• COMPRESSORS TO 30 P.S.I.
• VACUUM PUMPS TO 28 IN.
"Air may be your answer!"

Circle 55 on Time-Saver Card

FLUID POWER PATENTS

closed, since the piston is balanced by system pressure at both ends.

Relief pressure is adjusted by varying the spring force on the pilot valve. When system pressure overcomes this spring force, the pilot opens and fluid in the cavity behind the piston drains to tank. The resulting pressure drop across the orifice unbalances



the valve piston, and system pressure at the outlet port moves the piston left opening the bottom tank port.

When system pressure drops, the pilot valve closes and stops flow through the orifice. With balanced pressure in the piston the spring again moves it to the right closing the passage to tank.

Features of the venturi type construction are chatterless operation, elimination of shock, and full system relieving capacity.

U. S. Patent No. 2,861,585 *by Robert E. Becker, assigned to Logansport Machine Co., Logansport, Ind.*

Other Patents Issued

VALVE SPOOL DESIGN

No. 2,908,292 *by Donald E. Beckett and William N. Beckett, assigned to Beckett-Harcum Co., Wilmington, Ohio.*

FLUID CONTROL VALVE

No. 2,908,291 *by Nathan C. Hunt, assigned to Hunt Valve Co., Salem, Ohio.*

SINGLE-ACTING CYLINDER

No. 2,908,251 *by Jean Louis Gratzmuller, Paris, France.*

HYDRAULIC BOOSTER

No. 2,909,035 *by Robert E. Mitton, assigned to Hydraflex Corp., Dallas, Texas.*

Steel

'VSG'

Regd Trade Mark

For many years the precise control associated with 'VSG' variable delivery hydraulic pumps and transmission gears has proved invaluable to the Steel Industry.

Mill and drawbench drives, sawing and measuring tables, processing machines and manipulators are a few examples of the many applications of 'VSG' equipment.

The Steel Industry is but one of many industries which 'VSG' has now been serving for over fifty years.

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in capacities from 8 to 25 gallons... up to 1000-1500 psi

Engineered by the world's largest manufacturer of hydraulic jacks, Hein-Werner pumps, motors and valves offer compact, high precision, light weight, balanced design. *Valves offer*: large oil passages, close grained high tensile body castings, spring centered ball detent hold, pressure relief valve and hardened seat INSERT for long life. *Motors and Pumps* feature forced lubrication and internal bleeding for axial balance and to eliminate high pressures against oil seals; rotation in either direction, heavy duty roller bearings and gear type constant displacement.

FOX RIVER MFG. CO.
A DIVISION OF
Hein-Werner CORPORATION
OSKOSH 4, WISCONSIN 5014

Circle **50** on Time-Saver Card

NEW PRODUCTS

Continued from page 54

PILOT-OPERATED CHECK VALVE
. . . no spool hunting

Designation: Model POC-75

Features: If valve is connected directly to bottom of cylinder holding heavy load, it prevents load from falling freely if hose or pipe breaks. Can also meter exhaust flow from bottom of 2-way cylinder at same rate as input flow to rod. Prevents cavitation lowering problems. Built-in dampening chamber of spool causes it to move with smooth, deliberate action when pressure is applied. Spool has holes crosswise to direction of travel. These provide gradual increase of flow as valve opens, and gradual Shutoff.

Specifications: ¾" inlet and outlet ports, ⅜" pilot port. Capacity is 30 gpm. Maximum pressure is 3000 psi.

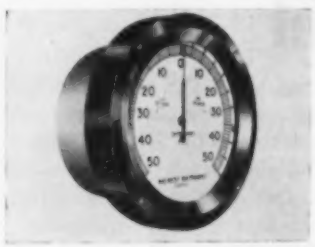
Brand Hydraulics
Omaha, Nebraska

Circle **308** on Time-Saver Card

DIFFERENTIAL GAGE
. . . has jeweled movement

Designation: Type 109

Features: Encapsuled Bourdon tube element gives greater overrange protection, reduces maintenance costs.



Jeweled bearing movement assures magnetic transmission of Bourdon tube motion. Extremely low hysteresis and tracking error.

Specifications: For working pressures to 4000 psi, to 400 psi differential. Dials 4½" and 6".

Mid-West Instrument
Div. Astra Assoc., Inc.
Detroit, Mich.

Circle **309** on Time-Saver Card

HYDRAULIC POWER UNIT
. . . for 250 psi

Features: Compact unit maintains low fluid temperatures. Can be supplied with accumulators, pressure switches, and unloading valves to specific requirements.

Specifications: Flow rates to 3.4 gpm at 2000 psi. For pressures to 2500 psi.

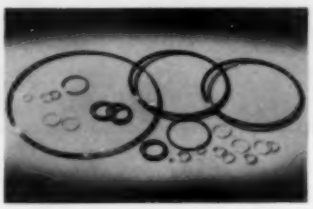
J. E. Myles, Inc.
Detroit, Mich.

Circle **310** on Time-Saver Card

METALLIC STATIC SEALS
. . . for zero leakage

Designation: Apex

Features: Compressive force is balanced on seal and seal coating, material, and thickness, so that coating



is forced into tool marks of seal cavity. Lapped sealing surfaces. High flange loads are not required. Flanges may be made thinner, with wider bolt spacing. Normal flange finishes are suitable for no-leak applications. Although 32-rms surface finish is recommended, 100-rms surfaces may be sealed.

Specifications: Can be supplied to seal irregular shapes and sizes, and all standard AN cavities. Materials include K Monel, 17-7 P.H., and Inconel X. For temperatures to 1750 F. Coating materials include Teflon. Special material for 2200 F. OD from .125" to 6.000".

Servotronics, Inc.
Buffalo, N. Y.

Circle **311** on Time-Saver Card

Continued on page 132

Circle **74** →

Jal·Smooth Tubing Solves Piston Ring Problem

The Problem: You have a patented shock absorber design which cuts production costs, but it requires a *rubber* piston ring. The Solution: Use Jal-Smooth, J&L's mandrel-drawn Electricweld tubing, with superior special smooth I.D. finish. Example: The Gabriel Company, Cleveland, Ohio.

"We use Jal-Smooth tubing because of its bore smoothness, its fine uniformity, and the substantial cost reduction its use permits," says R. H. Whisler, chief engineer for the Gabriel Company. "Our average acceptance rate is 99.5%, quite impressive since we produce over 1,000,000 pieces in a typical month."

A rubber O-ring, instead of the piston itself, makes contact with the walls of the innermost cylinder in Gabriel shock absorbers. This inner cylinder is a key portion of the standard Gabriel shock absorbers. Under road conditions, piston movement is abrupt, often violent. Any roughness or lack of uniformity in the Jal-Smooth tubing would cause trouble, and customer complaints. The consistent quality of Jal-Smooth tubing fully satisfies Gabriel's design needs. To see for yourself the quality of Jal-Smooth mandrel-drawn tubing, call your J&L representative or write direct to:

Test machine shown here simulates road conditions. Inner cylinders of completed shock absorbers must endure more than 2,000,000 cycles during testing.

Cutaway drawing shows standard Gabriel shock absorber. Inner cylinder is fabricated from 15-foot lengths of mandrel-drawn Jal-Smooth tubing. Intermediate tubing is also made by J&L. Cylinder smoothness and uniformity permit use of patented rubber-ringed piston.

This Steelmark identifies products made of steel. Place this mark on your products. And—look for it when you buy.

Steel

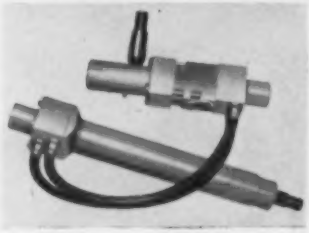
Jones & Laughlin Steel Corporation

STEEL ELECTRICWELD TUBE DIVISION • 3 GATEWAY CENTER, PITTSBURGH 30, PA.

NEW PRODUCTS

POWER STEERING SYSTEMS . . . are compact

Features: Full-time or part-time. Selection of spring controls degree necessary driver effort. Manual steering through mechanical steering gear. Attaches to steering linkage on vehicle's undercarriage. Used as integral linkage unit or remote unit. Servovalve and choice of 4



cylinders, 3 pumps. Each size capable of wide range of axle loadings.

Specifications: Cylinders for pressures to 2000 psi. Strokes are 8"-17". Diameters are 1½"-3¼". For axle loadings from 1500 to 128,000 lb.

Vickers, Inc.
Div. Sperry Rand Corp.
Detroit, Mich.

Circle **312** on Time-Saver Card

BACK-UP RINGS . . . for O-rings

Designation: Parbaks

Features: Concave shape prevents O-ring extrusion, increases lubrication. No spiral, no cut. Can't cut O-rings because of improper installation or worn back-ups. Resist

practically all liquids and gases. For all standard-pressure systems.

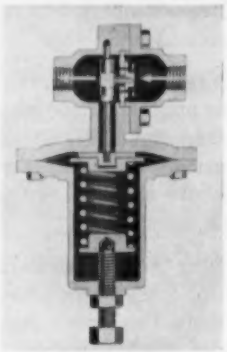
Specifications: For —85 to 350 F. Standard sizes.

Parker Seal Co.
Div. Parker-Hannifin Corp.
Culver City, Calif.

Circle **313** on Time-Saver Card

LOW-FLOW, SLIDING GATE SEATS . . . for 1¼"-3" sizes

Features: For regulators and control valves. For initial low flow, later high flow. For strength of line-size valve, low flow. Replace seats



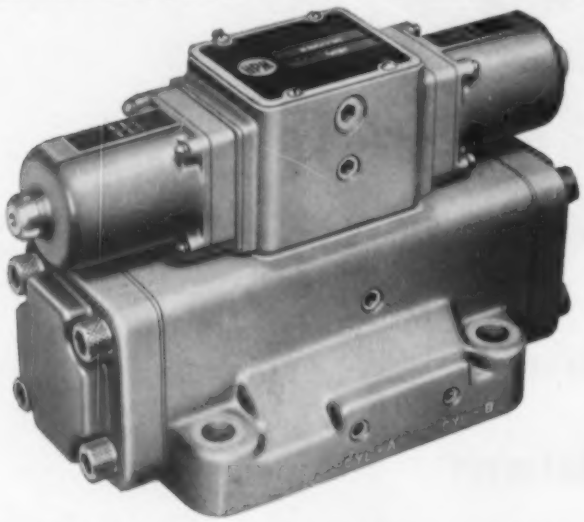
in oversized valve body. Stainless steel. Hard chrome finish. Self-lapping, self-cleaning.

Specifications: 1¼" body size can have capacity of 1", ¾", ½", ⅜", or ¼". Capacity of ¼", ½", 1" valves can be increased.

OPW-Jordan Corp.
Cincinnati, Ohio

Circle **314** on Time-Saver Card

Continued on page 134



NEW H-P-M 1¼" 4-Way Valves Pilot Operated, Solenoid Controlled

The new H-P-M 1¼" 4-Way Valves are designed for continuous service at pressures up to 3000 psi. They feature oil-immersed solenoid pilot valves as standard to lessen shock and wear on both solenoids and valves. They are completely interchangeable with industry standards and are available from stock for immediate delivery.

The new 4-Way Valves offer unusually good flow characteristics. Pressure drop charts, the results of actual tests, are available. Send for your copy, today. Complete dimensional specifications will be included.

Choice of seven spool types; single or double solenoid pilot control; either straight or side outlet subplates available.

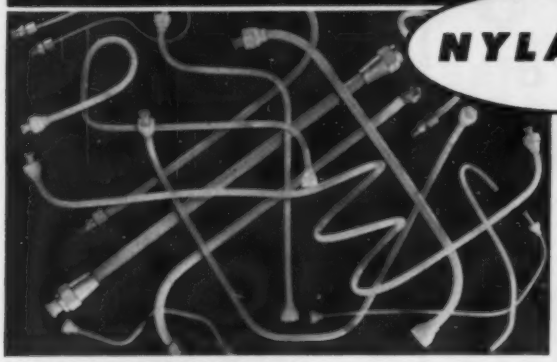
H55

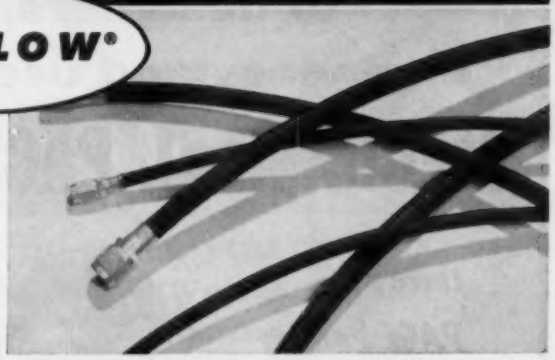
THE HYDRAULIC PRESS MFG. COMPANY
A Division of Koehring Company, Mount Gilead, Ohio, U.S.A.

Circle **70** on Time-Saver Card

STRONGER • LONGER FLEX LIFE • LIGHTER • MORE ECONOMICAL

NYLAFLOW®





PRESSURE TUBING

. . . a specially processed flexible polyamide tubing engineered for conveying air, liquids and gases.

Outstanding Performance Characteristics

High pressure rating at low cost. High resistance to flex and vibrational fatigue. Mechanically strong—resists abrasion and impact. Corrosion resistant, unaffected by oils, hydraulic fluids including non-flammable synthetic hydraulic oils, carbonic acid, alkalies and most solvents. Odorless, tasteless, non-toxic, non-corrosive, fungus resistant. Will not embrittle in storage. Serves wide temperature range: as low as −100°F., up to +225°F.

Ease of Installation

Use with standard metallic flare and flareless fittings. Flexibility can eliminate pre-bending, flexible couplings, intermediate fittings. Easily cut and flared. Can be installed and fastened around existing equipment. Quickly bent with clips or permanently prebent with heat. Requires no deburring. Light (1/7 weight of copper), easy to handle.

Where to use Nylaflow Pressure Tubing

The superior characteristics provided by Nylaflow have proved applicable to the following:

- Lubrication lines • Hydraulic lines • Pneumatic lines
- Oil or fuel lines • Beverage and syrup lines
- Vacuum lines • Caustic or solvent lines

FLEXIBLE PRESSURE HOSE

. . . an all-synthetic polyamide tube reinforced with high tensile strength yarn for outstanding flex resistance.

Outstanding Performance Characteristics

High pressure rating with small O.D. to I.D. ratio. Excellent resistance to fatigue when flexed and pressure pulsed. Lightweight—approx. 1/5 that of rubber hose. Mechanically strong—resists abrasion and impact. Unaffected by flammable and non-flammable hydraulic fluids. Excellent resistance to caustics and nearly all organic solvents. Low freon permeability. Odorless, non-toxic, non-corrosive, fungus resistant. Will not embrittle in storage. Retains excellent flexibility and toughness in temperatures as low as −80°F. Can operate constantly in temperatures up to 200°F., intermittently in temperatures as high as 300°F.

Ease of Installation

Can be permanently heat-formed to small, stress-free bend radii. Available in long continuous lengths. Form stable—will not sag or fall into surrounding equipment.

Uses for Nylaflow Pressure Hose

Nylaflow pressure hose has performance and cost advantages for the following type applications:

- Hydraulic lines • Fuel and oil lines • Freon lines
- High pressure CO_2 lines • High pressure lubrication lines
- Hot water lines (150° and below)
- High pressure pneumatic lines • Solvent or hot paint lines

THE DESIGN AND PERFORMANCE CAPABILITIES OF NYLAFLOW PRESSURE TUBING AND NYLAFLOW FLEXIBLE PRESSURE HOSE ARE OUTLINED IN BULLETINS AVAILABLE FROM THE POLYMER CORPORATION OF PA., READING 7, PA. WRITE FOR YOUR COPY TODAY.

POLYPENCO

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TYPE	SHORT TIME BURST RATING*	NYLAFLOW TUBING STOCK SIZES AVAILABLE					
T	1000 psi	Outside Dia.	⅛"	5/32"	¼"	5/16"	⅜"
		Inside Dia.	.096"	.139"	.190"	.242"	.295"
		Minimum Bend Radius	½"	1"	1½"	2"	3"
		Standard Coil Length	500 ft.	250 ft.	200 ft.	150 ft.	100 ft.
H	2500 psi	Outside Dia.	⅛"	5/32"	¼"	5/16"	⅜"
		Inside Dia.	.078"	.110"	.150"	.188"	.225"
		Minimum Bend Radius	½"	½"	1½"	2"	2½"
		Standard Coil Length	500 ft.	250 ft.	200 ft.	150 ft.	100 ft.

*Conditions such as length of time under pressure, temperature and humidity affect actual burst pressures. Although testing for a particular purpose is recommended, a safety factor of 4 to 1 can be considered good engineering practice for many applications.

HOSE PART NUMBER	NYLAFLOW HOSE SELECTOR										
	802-A	803-A	804-A	805-A	806-A	808-A	503-A	504-A	505-A	506-A	508-A
Inside Dia., size (in.) & tolerance	⅛" ± .008	5/32" ± .008	¼" ± .010	5/16" ± .012	⅜" ± .015	½" ± .018	5/16" ± .008	¼" ± .010	5/16" ± .012	⅜" ± .015	½" ± .018
Outside Dia. size (in.)	.215	.312	.425	.485	.560	.805	.290	.385	.435	.535	.675
Max. Operating Pressure (psi)	2000	2000	2000	2000	2000	2000	1250	1250	1250	1250	1250
Minimum Proof Pressure (psi)	4000	4000	4000	4000	4000	4000	2500	2500	2500	2500	2500
Minimum Burst Strength (psi)	8000	8000	8000	8000	8000	8000	5000	5000	5000	5000	5000
Max. Elongation at 3000 psi (%)	±2	±2	±2	±2	±2	±2	±2	±2	±2	±2	±2
Minimum Bend Radius (in.)	1.75	2.25	2.5	3.0	3.5	4.5	2.25	2.5	3.0	3.5	4.5
Weight (lbs. /100 feet)	1.87	2.29	3.97	4.35	6.60	14	1.87	2.78	3.17	5.18	8

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PAGE BELTING COMPANY
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Circle **101** on Time-Saver Card

NEW PRODUCTS

PRESSURE REGULATORS . . . of die-cast zinc

Designation: No. 6 for LP gas, No. 7 for acetylene gas

Features: Brass internal parts. Buna-N diaphragm and disc. Use as 2, 3, or 4-way.

Specifications: In ¼" size.

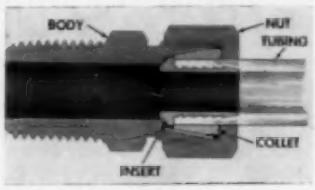
Watts Regulator Co.
Lawrence, Mass.

Circle **315** on Time-Saver Card

BRASS FITTING . . . for plastic tubing

Designation: Viseal

Features: Even under high vibration and internal pressure, fitting never needs retightening. Cold flow can't make tubing pull out. Brass insert holds tube firmly, prevents



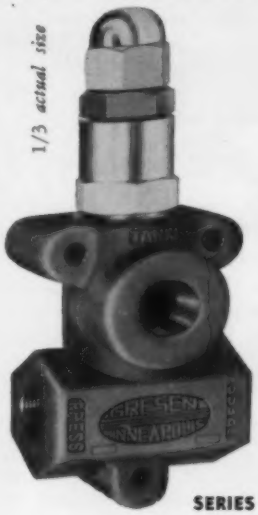
collapsing. Collet fits over tubing and insert. When nut is tightened, slots in sleeve allow it to compress firmly and evenly around tubing. No notching, pinching, or cutting of tubing. Prevents overtightening. Fitting can be reassembled. Provides the same holding power with copper, steel, and aluminum tubing, without notching or pinching.

Commonwealth Brass Co.
Detroit, Michigan

Circle **316** on Time-Saver Card

Continued on page 136

Circle **59** on Time-Saver Card



TWO NEW RELIEF VALVES

SERIES J *(High-lift ball and spring type)*

ONLY $16.50*

SERIES PJ *(pilot operated)* **$19.50**

Both series feature unique design for minimum *crack* to *full-flow* pressure differential and smooth, quiet operation. Both series, designed for *in-line* mounting, are available in ¾" and 1" pipe sizes and ¾", ⅞", and 1" tube sizes. Pressure adjustment range: 400-2500 psi for the PJ series, 400-2000 psi for the J series. Capacities up to 40 gpm (PJ series), 16-38 gpm (J series).

**Prices are FOB Factory and subject to trade discounts*

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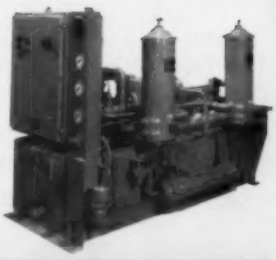

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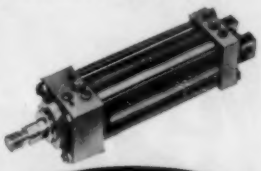
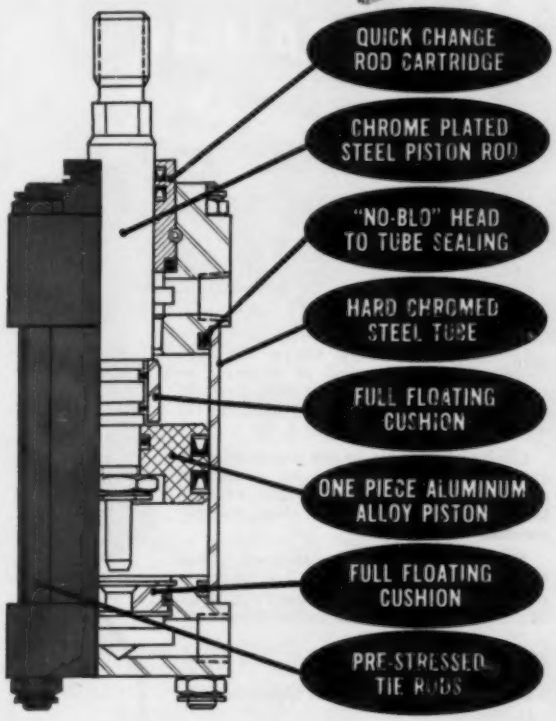
LINDBERG

SQUAREHEAD CYLINDERS

DESIGN IN LINDBERG AND . . . ADD ALL THESE FEATURES!
and many more besides!

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CHROME PLATED STEEL PISTON ROD
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HARD CHROMED STEEL TUBE
FULL FLOATING CUSHION
ONE PIECE ALUMINUM ALLOY PISTON
FULL FLOATING CUSHION
PRE-STRESSED TIE RODS

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SQUAREHEAD "S" LINE—	BULLETIN S-101
2000 PSI "H" LINE—	BULLETIN H-101
HEAVY DUTY "A" LINE—	BULLETIN A-101

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LINDBERG AIR and HYDRAULIC DIV.

TEER-WICKWIRE & CO.

1802 WILDWOOD AVE. • JACKSON, MICHIGAN

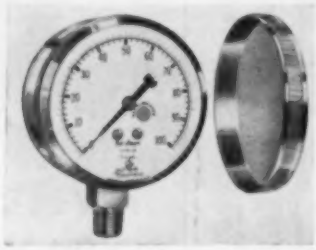
Circle **126** on Time-Saver Card

NEW PRODUCTS

INSPECTORS TEST GAGES . . . have 3" dials

Designation: Type 28

Features: Gages have knurled, screwed ring for quick access to Recalibrator. Have Readeasy dial and twisted knife-edge pointer. Polished brass, nickel, or chrome finishes. Heavy brass cases. Protective covers available.



Specifications: Accurate within ½ of 1% plus or minus the maximum dial reading over entire range. 11 pressure ranges from 0-15 through 0-1000 psi. 7 compound ranges from 30" to 15 psi through 30" to 300 psi.

Marsh Instrument Co.
Skokie, Illinois

Circle **317** on Time-Saver Card

Capital

HYDRAULIC FILTERS

for Hydraulic and Oil Re-circulating Machinery

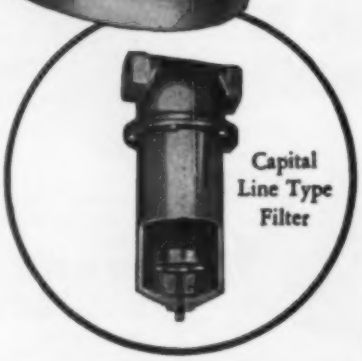
Capital Hydraulic Filter Units are smaller than ordinary filters but with filtering capacity equal or superior to many larger filters. Small size permits greater latitude in design, particularly where space is restricted.

Capital Filter Units are designed with one-piece construction — no screws or nuts to work loose and be lost or mislaid. Simple and easy to clean by any method.

Made from specially designed woven Monel wire, with narrow corrugations presenting the greatest filtering area. Monel support supplies extra sturdiness.

Capital Filter Units are made in 4 Types:

- MONO-BILT 60 Mesh All Stainless Steel (Sump type).
- MONO-BILT Standard All Stainless Steel
- MONO-ECONO Mono-Bilt with Monel Metal Insert and Cadmium Plated Top and Bottom.
- LINE TYPE with Aluminum Housing and Mono-Bilt, one Piece Filter Unit.



Capital Line Type Filter

Built from Monel Metal they are impervious to rust and corrosion.

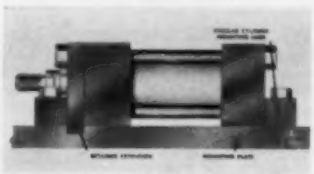
CAPITAL ENGINEERING & MFG. CORP.

5836 SOUTH ASHLAND AVENUE, CHICAGO 36, ILLINOIS

Circle **27** on Time-Saver Card

CYLINDER MOUNTING . . . does not shift

Features: Installs quickly. Eliminates bolting, pinning, and welding of keys. Flange plate for side-mounted cylinders extends beyond cylinder's mounting-side surface. Plate is ground to accurate thickness. To mount cylinder, slip extending portion of flange plate into slot milled into machine's mounting surface. Secure cylinder by



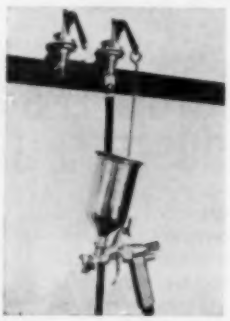
standard mounting provided with cylinder. For maximum loads. In side lug, flush side, and end lug.

Miller Fluid Power Div.
Flick-Reedy Corp.
Bensenville, Illinois

Circle **318** on Time-Saver Card

QUICK-ACTING STOP VALVE . . . for air, gas, liquids

Features: Quick closing stops flow in lines and hoses. Saves air, relieves pressure on hand tools and



hoses. Hand, foot or cam operated. Mountable in any position.

Specifications: 375-psi pressure, cast bronze body, Buna N diaphragm and disc. Inlet ¾", outlet ½", pipe thread.

Milo Manufacturing Co.
Elizabeth, N. J.

Circle **319** on Time-Saver Card

Continued on page 138

Circle **127** →

Circle **87** on Time-Saver Card

Specifications: 1" bores. Strokes

WEAR RESISTANT
THOMSON

60 Case

AVOID the HIGH COST and difficulty of fabricating long, hard & straight parts by conventional methods!

hardened and ground

SHAFTS, ROLLS, GUIDE RODS and other long-round parts

ELIMINATE WEAR and REDUCE COST

60 Case is the result of over 15 years of experimental work and production experience with hardened and ground shafts which are a requirement for BALL BUSHINGS, the Linear Ball Bearing manufactured by Thomson Industries, Inc.

The special techniques and equipment that have been developed enable high production rates and low handling costs. This permits big savings over conventional methods which are plagued with erratic warpage, straightening and resultant grinding problems. Finished *60 Case* parts frequently cost less than the scrap losses that result from conventional methods.

60 Case material has a surface hardness close to 60 on the Rockwell C scale which is essential to resist wear.

Long lengths of material ranging in diameter from ¼" to 4" are stocked to enable prompt shipment of *60 Case* parts, with or without special machining. *Write for literature and name of your local representative.*

For emergency needs call collect
MAnhasset 7-1800

ADVANTAGES of *60 Case*

- COST REDUCTION
- GROUND FINISH
- HARD BEARING SURFACE
- STRAIGHT PARTS
- NICK-& DENT-PROOF
- DELIVERY FROM STOCK
- ACCURATE DIAMETERS
- ADDED STRENGTH
- UNIFORM HIGH QUALITY

TYPICAL *60 Case* PARTS

GUIDE RODS • SHAFTING • ROLLS • TRAVERSE RAILS
PISTON RODS • ARBORS • LEADER PINS • TIE RODS
KING PINS • AXLES • CONTROL RODS • GUIDE POSTS
MANDRELS • BEARING ROLLERS • SPINDLES

THOMSON INDUSTRIES Inc.
Dept. C-4, Manhasset, New York

PARTS HARDENED to 60 C...
increase life... reduce cost!

Circle **87** on Time-Saver Card

If it's a pressure gauge or dial thermometer

MARSH MAKES IT!

No name is so expressive of accuracy and dependability as the name, Marsh, on a pressure gauge or dial thermometer. Types, ranges and styles are endless. To know the scope of Marsh Instruments—

MARSH INSTRUMENT COMPANY
Dept. 19, Skokie, Ill.
Division of Colorado Oil & Gas Corporation
Marsh Instrument & Valve Co., (Canada) Ltd.
8407 103rd St., Edmonton, Alberta, Canada
Houston Branch Plant, 1121 Rothwell St.,
Sect. 15, Houston, Texas

NEW PRODUCTS

MIDGET AIR CYLINDERS . . . are double-acting

Features: Neck, angle-leg, or clevis-mounted. Brass body, piston, and end plates. No tie rods. Replace

cartridge-type bronze bearings and piston rod seals without dismantling cylinder. Packing of molybdenum disulphide grease. Sefl-adjusting U-cup piston seals.

Specifications: 1" bores. Strokes are 1", 2", 3", 6", 9", 12". Smallest cylinder's length is 4-19/32". Largest cylinder's length is 15-19/32".

A. Schrader's Son
Div. Scovill Mfg. Co., Inc.
Brooklyn, N. Y.

Circle **320** on Time-Saver Card

HYDRAULIC HAND PUMP . . . has dual displacement

Features: For small capacity fork-lift trucks and stackers. Quick lift when platform is unladen. Changes automatically to normal when machine carries load. No manual adjustment necessary. Interchangeable with standard fixed-delivery unit.

Specifications: One type gives 2½ times normal output under low pressure; the other, 3½ times.

Power Jacks Ltd.
London, England

Circle **321** on Time-Saver Card

UNLOADING VALVE . . . has internal pilot

Features: Automatically diverts full pump flow to reservoir when system

Continued on page 140

TRU-FLATE.

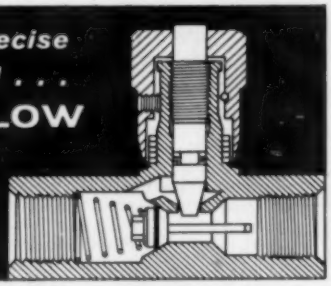
STANDARD AND HEAVY DUTY QUICK COUPLERS SINCE 1928

TRU-FLATE, INC.
888 - 92nd AVE OAKLAND 3, CALIF

WRITE FOR FREE COPY OF TRU-FLATE'S INDUSTRIAL CATALOG NO. 4

Circle **130** on Time-Saver Card

For more precise Flow Control . . .
COLORFLOW FLOW CONTROL VALVES



. . . with exclusive color and number calibrated adjustment

- **Simple reading, recording, setting and adjusting**
- **Safe — adjustable under pressure**
- **Setting can be locked to hold adjustment**
- **Extremely sensitive — provides high flow and minimum pressure drop**

- **For oil, gas, vacuum, water and other fluids**
- **Pressures: Brass to 2000 psi Steel to 5000 psi**
- **Sizes: ⅛, ¼, ⅜, ½ and ¾" dry seal pipe threads**

Write for detailed literature

THE MANATROL Corp.
2372 W. 7th St. • Cleveland 13, O • CH 1-0575

Circle **85** on Time-Saver Card

Circle **60** on Time-Saver Card

Make a good valve — — — — even better!

HADBAR bonded fluorosilicones improve component reliability in missile check-out systems. The bonded seal on this valve is resistant to fuels, nitrogen and helium...is compatible with LOX cleaning methods...functions in a temperature range of −80°F to +300°F. HADBAR may have the answer to your specific requirements in molded, extruded and bonded applications.

HADBAR INC.

9530 Gidley Street, Rosemead, California CU 3-4121
Northwestern Representative:
101 Jones Building, Seattle 1, Washington

STAFFA

HIGH TORQUE VARIABLE SPEED (1-100 r.p.m.) HYDRAULIC MOTORS

Mark IV—5 cylinder 4,500 lbs. ft. at 2,000 p.s.i. (Speed 1-100 R.P.M.) **Mark V**—7 cylinder 6,600 lbs. ft. at 2,000 p.s.i. (Speed 1-75 R.P.M.) Overall efficiency 90% to 95%.
Ideal drive for conveyors, rolling mills, cranes, tractors, drills and most mechanical handling applications.
Ask for details of hydraulic cylinders, valves, pumps and motors.

CHAMBERLAIN INDUSTRIES LTD

Staffa Works, Argall Ave., Leyton, London, E.10, England.
Leytonstone 3678
(Member of the Chamberlain Group of Companies)

Circle **31** on Time-Saver Card

Do You Have Control Valve Problems?

Let Us Help You With—

DESIGN
PROTOTYPES
PRODUCTION

If you are concerned with the design and production of control valves, flow regulators, or similar products, our engineering experience in this highly specialized field and our facilities for the developing of prototypes can solve your problems. Our sterile machining and assembly areas offer exceptional facilities for the volume production of units requiring extreme cleanliness and accuracy.

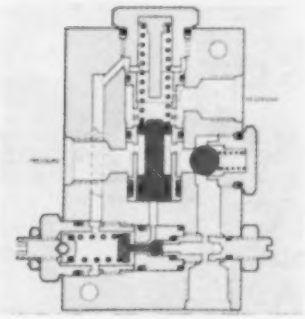
Quotations gladly submitted. A letter or phone call will receive immediate attention.

EATON — SAGINAW DIVISION — **MANUFACTURING COMPANY**
9771 French Rd. • Detroit 13, Mich.

NEW PRODUCTS

pressure reaches set point. Has 5% to 20% adjustable differential between load and unload pressures. Sliding spool will not stop half-way. Assures complete loading and unloading. Built-in check valve. For accumulator and hi lo circuits or for venting large relief valves.

Specifications: Unload pressure range is 800 to 3000 psi. Maximum



pilot pressure is 5000 psi. Measures 5" x 4½" x 1½". Ports are ½" SAE.

Fluid Controls, Inc.
Mentor, Ohio

Circle **322** on Time-Saver Card

AIR METER
. . . for 2" pipes

Designation: DO-150

Specifications: Measures air flow

from 10 to 150 cfm in 2-cfm increments. For 80 psi. Conversion factors permit readings at pressures from 2 to 300 psi. Accuracy is ±1%. Meter is 19" high. Weighs 31 lb.

New Jersey Meter Co., Inc.
Plainfield, N. J.

Circle **323** on Time-Saver Card

ULTRASONIC CLEANER
. . . flushes as it cleans

Designation: Pall-Cavitron HIPS

Features: Rotates element through hyperintense proximal field. Cleans

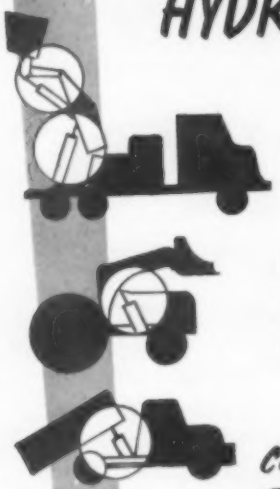
most elements in less than 10 minutes. Ultrasonic generator and transducer are modifications of system for machining metals and ceramics. Unit tests largest particle passed by cleaned filter, measures element's pressure drop.

Aircraft Porous Media, Inc.
Subs. Pall Corp.
Glen Cove, N. Y.

Circle **324** on Time-Saver Card

ON THE JOB...

with CROSS HYDRAULIC CYLINDERS



Stay "on the job" with dependable, rugged Cross Hydraulic Cylinders. Like Cross customers everywhere, you too, will appreciate the fast, courteous, dependable service you get from Cross. Phone for speedy delivery on any quantity...quality-built to your specifications. Contact Cross Engineering Department, today!

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CUSTOM DESIGNED CYLINDERS FOR EVERY APPLICATION

Try CROSS CYLINDERS in your operation... low cost, dependable, and trouble free.

Lowest-Priced Engineered Quality Cylinders Available..

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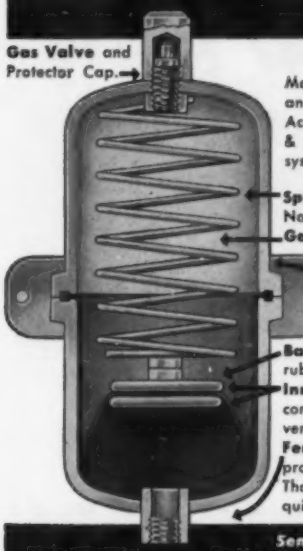
WRITE • WIRE • PHONE...TODAY!!

Circle **38** on Time-Saver Card

SPeeCo EASILY SERVICED...

ACCUMULATORS



Gas Valve and Protector Cap.

Most economical and efficient Accumulator for absorbing shock & storage of energy in hydraulic systems. Sizes, 15 to 7500 cu. in.

Spring—Directs bottom of Barrier. No collapsing of Barrier sides.

Gas Chamber—gas precharged to suitable pressure.

Steel Shell—Two sections. Up to 2000 psi pressure.

Clamp Ring—Holds sections firmly. Easily removed.

Barrier—"Hat Shape." Synthetic rubber."O"ring seals shell sections.

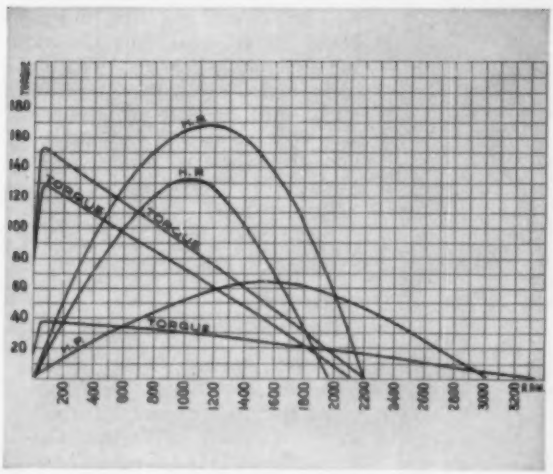
Inner and Outer Plates—Starts convolutions of barrier and prevents extrusion through liquid port.

Female Pipe Threads—Can be provided to meet specifications.

Thorough cleaning maintenance is quickly performed when necessary.

Send for specifications and descriptive literature at once.

SPECIAL PRODUCTS COMPANY
15000 WEST 44TH AVENUE
GOLDEN, COLORADO

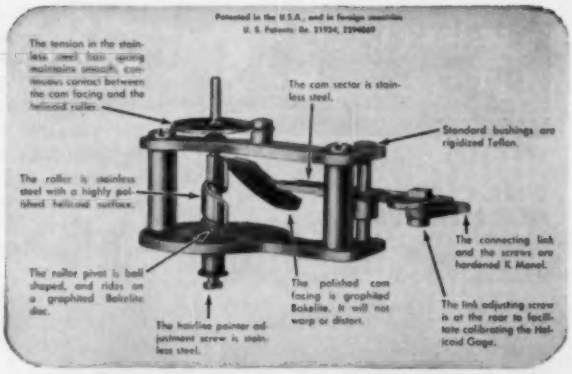


HIGH STARTING TORQUE. Power curve shows high starting torque of this Gardner-Denver 5-cylinder, radial air motor. Smooth, overlapping power impulses for tugging power at low speeds.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Ave., Toronto 16, Ontario

GARDNER-DENVER


Patented in the U.S.A., and in foreign countries
U. S. Patents: Re. 21934, 2394689
The tension in the stainless steel face spring maintains smooth, continuous contact between the cam facing and the helicoid roller.
The cam sector is stainless steel.
Standard bushings are rigidized Teflon.
The roller is stainless steel with a highly polished helicoid surface.
The connecting link and the screws are hardened K Monel.
The roller pivot is ball shaped, and rides on a graphited Bakelite disc.
The polished cam facing is graphited Bakelite. It will not warp or distort.
The link adjusting screw is at the rear to facilitate calibrating the Helicoid Gage.
The hairline pointer adjustment screw is stainless steel.

Exclusive Helicoid movement provides *Sustained Accuracy* ...on the toughest jobs!

• Helicoid Gages have no gears, no teeth—wear is reduced to an absolute minimum. No danger of fouling, either—rolling action of cam facing keeps contact surface clean. Even when subjected to violent pressure pulsations or mechanical vibrations, Helicoid Gages *stay* accurate. Only Helicoid Gages provide *all* these advantages:

Sustained accuracy—Helicoid movements have been tested through 75,000,000 cycles, with virtually no wear or loss of accuracy. Conventional *geared* gages on the same test became useless after only 500,000 cycles.

Durability—Bourdon tubes won't stretch, leak or crack. Dial faces won't corrode or chip.

Wide selection—Gages are available for practically any application from tap water to acid. Gages include flanged and flangeless, round and square, in standard and flush-mounting models. Accessory equipment includes gage cocks, needle valves, siphons and snubbers.

NEW! Solid-Front Safe-T-Case Gage

This new Helicoid design diverts the force of a burst in a backward direction, away from the operator. The force escapes by deforming the back cover plate, which can then be replaced inexpensively.

Write for Catalog DH-65 for details on the complete line of Helicoid Gages

Distributed in Canada by Upton, Bradeen & James, Ltd.
Quebec, Montreal, Ottawa, Toronto, Hamilton, Windsor, Winnipeg, Edmonton, Vancouver

HELICOID GAGES

Helicoid Gage Division • American Chain & Cable Company, Inc.
929-H Connecticut Ave., Bridgeport 2, Conn.

ACCO

USEFUL LITERATURE

Continued from page 62

WIRE CLOTH FILTER ELEMENTS

Elements for cryogenic applications to —425 F. Elements for hot gases to 1800 F. With backup meshes, elements for differential pressures to 5000 psi. Thin-wall, pleated construction. High density of pores per unit area. Most elements are of 18-8 stainless steel. Others of N-155, L-605, Inconel, nickel, copper, steel, Nichrome, and other stainless steels. Pleating allows maximum surface with mimimum space and weight. In plain weave, Dutch weave, and twilled Dutch weave. Wire diameters from .001" to .020". Cloth thickness from .003" to .060". Nominal pore ratings for Poromesh from 2 to 1000 microns. For Micromesh, from 5 to 1000 microns. Poromesh has each wire bonded at all contact points by sintering in pure, dry hydrogen. No external bonding agents. Brochure 142. Four pages. *Bendix Filter Div., Bendix Corp., Madison Heights, Mich.*

Circle **413** on Time-Saver Card

BELLOWS

Welded diaphragm bellows has reduced hysteresis. Applied pressure can't change bellows' diameter. Bellows can nest under maximum travel, before deformation can take place. Bellows then acts as a solid, not as a spring. Used in fluid power components—bellows pumps, accumulators, packless valves, pressure surge tanks, and pressure switches. Design guide 77BBP also covers production and testing. *Breeze Corp., Union, N. J.*

Circle **414** on Time-Saver Card

CYLINDERS & VALVES

Catalog shows complete line of air cylinders, valves, clamps, and dial feed tables. Price lists. 88 pages. *Allenair Corp., Mineola, N. Y.*

Circle **415** on Time-Saver Card

FITTINGS WALL CHART

Wall or desk chart covers complete line of steel and brass fittings. Flared and flareless tube fittings, and pipe fittings analyzed by fitting styles, typical applications, types of tubing used, pressure, temperature, and vibration ratings, and application advantages and disadvantages. From 6173. *Weatherhead Co., Ft. Wayne, Indiana.*

Circle **416** on Time-Saver Card

LIQUID COMPRESSIBLE DEVICES

Liquid springs, Spring Shoks, Time Delay Shoks, suspensions, piped systems, dashpots. Handbook shows principles of devices. Cutaways. Specifications. Charts, graphs, design data. Devices use limited compressibility of high-pressure liquids. Liquid is in closed cylinder, generally under initial pressure which generates initial force (preload). As moving piston reduces volume in cylinder, spring force increases. Liquid springs provide to 40 times the force of equivalent mechanical springs. Approach rate of expansion of explosives. For spring and shock absorber in same envelope, one end of spring piston

Continued on page 144

AMERICAN

PRECISION BORED & HONED PARTS

TO SPECIFICATIONS

Our exclusive business is the manufacture of deep bored parts to the highest precision standards. We assume the complete responsibility for supplying bored parts in specified materials, physicals and finishes. We are equipped with the special tools and skills to produce your unusual bored and honed part in diameters up to 16 inches and lengths to 40 feet.

Get better aquainted with American. Write for our latest plant brochure.

AMERICAN HOLLOW BORING CO.

You can depend on American as a reliable source for precision bored and honed parts for your most exacting applications.

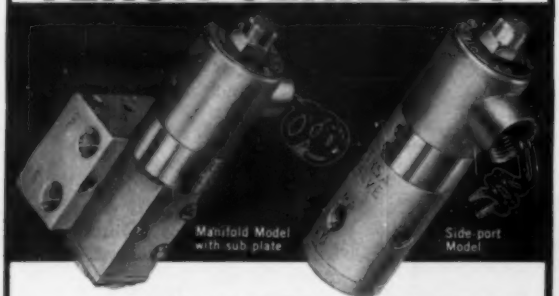
1060 WEST 20th ST. • ERIE, PENNA.

Circle **7** on Time-Saver Card

Circle **134** on Time-Saver Card

The Most Compact Solenoid Valve in the Fluid Power Control Field...

VERSA SERIES "A"



Versa's new four-way solenoid valves measure only 5⅛" high by 1⅝" diameter, yet have a full 3/16" diameter flow area. Completely corrosion-resistant and simple to install, Versa Series "A" solenoid valves are available in over 100 different variations. Triple pressure and functionally tested under water for guaranteed leakproofness.

VERSA

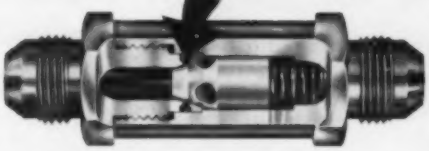
Write today for your free copy of Bulletin #1259

VERSA PRODUCTS COMPANY INC.
150 A COOLIDGE AVENUE
ENGLEWOOD, NEW JERSEY

Kep-O-seal®

RUGGED! DEPENDABLE! CHECK VALVES with the

Flexible Seal Seat*



- LEAK TIGHT! BUBBLE TIGHT!
- SURGE PROTECTED!
- FLOW—STRAIGHT THROUGH!
- LONG LIFE! EASY CLEANING!
- SIMPLE AND TROUBLE FREE!

The sturdy Kep-O-seal check valve can really take hard service. Conservatively rated, it absorbs severe shock from either direction and always holds its seal. *REMAINS LEAK TIGHT!* Has been proved outstanding in everything from machine tools to missiles! Investigate and see for yourself! Write for full details.

*Patent Applied For

KEPNER

KEPNER PRODUCTS COMPANY
7321 West 59th Street • Summit, Illinois

Circle **78** on Time-Saver Card

BRUNNER SINCE 1906

syn-on-y-mous with dependable air supply

Where dependable compressed air supply is a "must" there's likely to be a Brunner air compressor. Installation after installation proves Brunner air compressors . . .

1. Are outstandingly dependable
2. Offer single or 2 stage equipment in all sizes
3. Supply complete air or water cooled aftercooler assemblies with all fittings from one dependable source for all compressor sizes
4. Provide "entire system" duplex units that are "operation readied" to connect to piping and wiring facilities
5. And the air conditioning and heating experience of Dunham-Bush engineers enables them to professionally assist in layout for dependable control systems.

also **WATER COOLED AFTER COOLERS AND OTHER ACCESSORIES BY heat-x A DUNHAM-BUSH SUBSIDIARY**

REQUEST:

- *Bulletin #763 for water cooled specifications*
- *Catalog #36A for ½ through 20 H.P. data*
- *Catalog #653A for consolidated listings ¼-50 H.P.*

BRUNNER DIVISION
DUNHAM-BUSH, INC.
DEPT. AH, WEST HARTFORD 10, CONNECTICUT

Circle **26** on Time-Saver Card

USEFUL LITERATURE

is enlarged. Provides Large-area dashpot and small-area liquid-spring piston. Meters liquid displaced by dashpot. Same liquid is displaced and metered. Engineering Handbook CH. *Taylor Devices, Inc., North Tonawanda, N. Y.*

Circle **417** on Time-Saver Card

STATIONARY COMPRESSORS

Rotary-screw compressors offer 6900 to 19,400 cfm. Pressures to 115 psi. Low and high-pressure stages can be used as single stage compressors to deliver 2450 to 19,400 cfm at 15 to 40 psi. No lubrication inside compression chamber. AR heavy duty compressors have vertical, low-pressure cylinder; horizontal high-pressure cylinder. Two-element, water intercooler. Four-page folder Covers ER-6 heavy duty compressors, AT and ET air-cooled compressors, AR-E power pack units, NT and CT compressors. Photos. Charts of max. pressure, rpm, piston displacement, delivery, power requirement, cooling water requirement, and weight. *Atlas Copco, New York, N. Y.*

Circle **418** on Time-Saver Card

WALL CHART FOR HOSE, COUPLINGS, & FITTINGS

Two-color chart shows complete line of reusable products. Has illustrations, dimensions, and catalog numbers. 21" x 32". 10-page leaflet explains features of hydraulic hose, couplings and fittings for replacement use. Catalog D-1 gives detailed data, specifications, and instructions for these products. 24 pages. *Anchor Coupling Co., Inc., Libertyville, Illinois.*

Circle **419** on Time-Saver Card

PLASTIC PRODUCTS

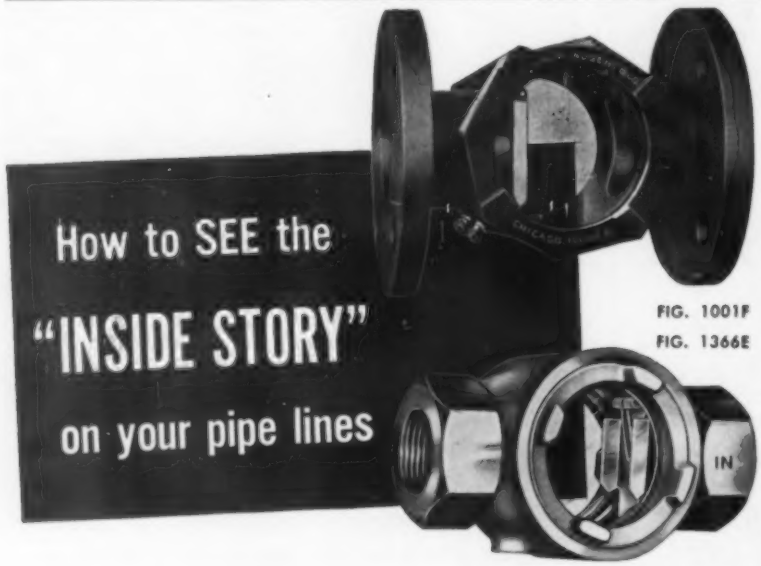
Catalog covers electrical and mechanical properties of Teflon. Has graphs of linear thermal expansion and coefficients of linear thermal expansion of annealed Teflon parts. Specific volume vs. temperature. Weight loss vs. temperature. Shows dimensions and properties of Teflon sheets. Describes Teflon molded tubes, extruded tubing, molded rods, extruded rods, skive tape, and envelope gaskets. Teflon stuffing-box packing, Vee-Flex packing, valve stem packings, braided and plastic packings. Teflon expansion joints and flexible couplings. Teflon flexible wire-braided hose, aircraft hose, and industrial hose. O-rings, back-up rings, and bearings. Similar products of Raylon and Kel-F. Charts of physical properties. 36 pages. *Raybestos-Manhattan, Inc., Manheim, Pa.*

Circle **420** on Time-Saver Card

AIR LINE UNITS

Air enters filter bowl through directional louvers, and sets up centrifugal flow pattern. Liquid particles forced to bowl's inside wall. Liquids then go to bottom of bowl. Baffles there prevents air turbulence from carrying them back into line. All air passes through element. Passages through filter are greater than internal area of pipe. Automatic drain for pipe sizes ¼" to 1", manual, for ⅛" to 1½". Diaphragm of regulator controls valve through valve pin. Adjusting screw loads adjusting spring. When screw is tightened, spring opens valve

Continued on page 146



Do you have pipe lines through which constant flow is a critical factor? Could slowdown or stoppage cause untold damage to valuable equipment? If it's important that you know what's going on inside a pipe line . . . Nugent Sight Flow Fittings can be one of the most economical investments you've ever made.

These fittings have large double windows to aid visibility. A spring compensated, hinged, indicator gate moves in proportion to the flow and is visible from either side, even when liquid is dark or discolored. Fittings available with electrical contacts to operate a bell or light should liquid flow cease. Sizes ⅜" to 6" inclusive . . . in brass, cast iron, and steel. Tapped or flanged.

Complete data upon request.

ESTABLISHED 1897

WM. W. NUGENT & CO., INC.

3432 CLEVELAND STREET, SKOKIE, ILLINOIS

REPRESENTATIVES IN PRINCIPAL CITIES

OIL FILTERS • STRAINERS • TELESCOPIC OILERS
OILING AND FILTERING SYSTEMS • OILING DEVICES
SIGHT FEED VALVES • FLOW INDICATORS

Circle **97** on Time-Saver Card

Circle **118** on Time-Saver Card

FASTER CYCLING

NEW IMPROVED

C4H SERIES

"FINEST... of the INTERCHANGEABLES"

Sheffer pioneered tapered cushions eliminate shock conditions on cushion entrance — permit faster cycling — greater production. BORES up to 30" — STROKES to 26 feet, on application.

Ask for NEW 16-page full color Bulletin 260

- **2000-3000 psi HYDRAULIC**
- **ALL STEEL CONSTRUCTION**
- **EASILY REMOVED ROD CARTRIDGE**
- **BORES 1⅛ thru 12**
- **17 MOUNTINGS**
- **MEETS or EXCEEDS J.I.C. STANDARDS**

THE SHEFFER® CORPORATION

Cincinnati 15, Ohio
Phone POplar 1-8227

NFPA

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SEE PHONE BOOK YELLOW PAGES

THE COMPLETE PACKING UNIT for Hydraulic or Pneumatic rods and cylinders

MON-O-PAK® CARTRIDGE

- **Easily and quickly installed.**
- **No adjusting necessary.**
- **Equipped with Anti-Backlash rings.**
- **Includes Seal-Guard® rod wiper.**
- **Low friction coefficient.**
- **Shock and burst proof.**
- **Reduces initial machining cost.**
- **Gives longer service life.**
- **Cuts machine down-time.**
- **Easily removed for replacement.**

Write for catalog and prices.

HYDRAULIC ACCESSORIES CO.
24301 Hoover Road, Warren Mich.

Circle **69** on Time-Saver Card

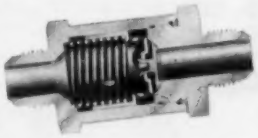
REPUBLIC VALVES FOR EVERY INDUSTRY

CHECKS THAT FILL YOUR NEEDS

MINIATURE CHECKS

Mini-Valve **Regular Size Valve**

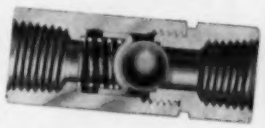
Save weight and space with Mini-Valves. They have same rated flow as regular size, but are only ¼ the size and weight. Good pressure drop characteristics. Temp. range −65° to plus 400°F. Operating pressure to 5000 psi. One-piece stainless steel body, in tube sizes 4 to 16 (¼" to 1" O.D.) Meets or exceeds requirements of MS MIL-V-25675. Port threading MS33514 flareless.



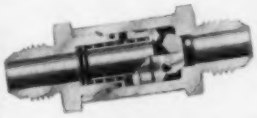
FREE-FLOW CHECKS

Extremely low pressure drop, with wide open flow. Molded elastomer seal and spherical seat prevent leakage at any pressure. Sizes ⅛" to 2" in brass and aluminum alloy up to 3000 psi, and stainless steel to 4000 psi. Opens at 2 psi. Temp. range −65° to 200°F. Pipe, internal straight thread and flared tube connections standard; MS33514 flareless available.

BALL CHECKS



Ruggedly constructed for intermittent non-shock hydraulic service up to 500 psi at temperatures −65° to 350°F. Sizes ⅛" to ¾". Brass, aluminum alloy, stainless steel. Pipe and flared tube connections.



HY-PRESSURE CHECKS

Built for continuous service in high velocity systems at pressures up to 5000 psi in steel and stainless steel, and 3000 psi in aluminum alloy. Low pressure drop. Metal-to-metal seal. Operating temperatures −65° to 250°F. Sizes ⅛" to 2", with pipe, internal straight thread and flared tube connections. MS33514 flareless available.

Distributors in principal cities coast to coast

CHECK RELIEF SELECTOR GLOBE NEEDLE PLUG

RM **REPUBLIC MANUFACTURING CO.**

15655 BROOKPARK ROAD • CLEVELAND 35, OHIO

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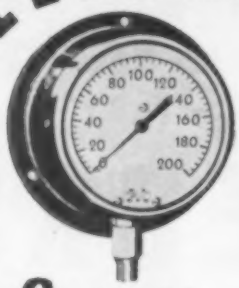
MARSHALLTOWN



Gauges

The right gauge for your specific needs

A complete line of gauges in stock available for early delivery. Gauges from 10-inches water pressure to 30,000 P.S.I. to meet your specifications on any equipment.

- Pressure
- Vacuum
- Compound
- Altitude
- Combination
- Diaphragm
- Hydraulic
- Special Purpose
- Dial Thermometer (Vapor Tension or Bi-Metal)

Let Marshalltown answer your gauge problems . . . write for information and prices.

MARSHALLTOWN MFG. CO.
MARSHALLTOWN, IOWA

USEFUL LITERATURE

downward. Regulated pressure increases until air force against bottom of diaphragm equals force of spring. Venturi lubricators for cylinders, tools, and other equipment. Photos and drawings for each type component. Selector charts list all models. Catalog 900b also shows combination units, and accessories. Valves shown include relief, safety, flow-control, and needle. Curves, complete descriptions. Engineering data. 82 pages. *C. A. Norgren Co., Englewood, Colorado.*

Circle **421** on Time-Saver Card

ELECTRIC MOTORS

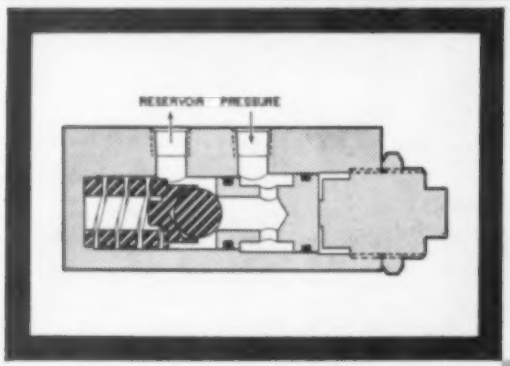
Fractional-hp, Form G general-purpose motors. Line includes capacitor-start, split-phase, permanent-split capacitor, shaded-pole, and polyphase. Sixteen types in NEMA sizes 48 to 56. Three-wick lubrication system bathes shaft. Thrust washer assembly withstands normal thrust from any direction, regardless of motor angle. Disk-type endshield places rabbet and bearing in same plane for accurate alignment. Quick connects for fast rotation change. Sliding planes for quick switching from 115 to 230 v. Large wiring compartment for easier connections. Color-coded, braidless Neoprene leads resist heat, moisture, and aging. Bulletin GEA-642A has photos and illustrations. List of product bulletins. 12 pages. *General Electric Co., Lynn, Mass.*

Circle **422** on Time-Saver Card

AIR COUPLINGS

Couplings in hose and pipe ends from ¼" to 1½". Hose clamps. Coupling gaskets. Valved couplings in four styles. High-pressure couplings withstand 1500 psi. 2 and 4-way valves. Hose fittings, menders, and clamps. Hose nipples. Manifolds. Blowguns. Model CA-11023 compressor flows 46.6 cfm. 10 hp, 700 compressor rpm. Cut-out pressure is 175 psi. Base-mounted units have air pump, motor, and check valve. 22 types and sizes of horizontal and vertical, tank-mounted compressors. ½ to 5 hp. 2½ to 23 cfm. Catalog C-59. *U. S. Air Compressor Co., Cleveland, Ohio.*

Circle **423** on Time-Saver Card



SAFE-FAST Relief Valves

- Can't stick open
- Won't leak
- Will prevent dangerous failures

- Sizes — ¼" thru 1" pipe (NPTF)
- For oil • Pressure Ranges — 500 to 8000 psi

Write for detailed literature

Fluid Controls, inc.

Member of National Fluid Power Association

Manufacturers of Hydraulic Valves and Devices
Relief Valves • Check Valves • Restrictor Valves
Needle Valves • Pilot Check Valves • Special Valves
Pressure Compensated Flow Regulators

P.O. BOX 186 • MENTOR, OHIO

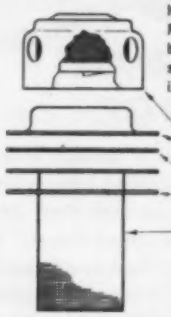
Circle **48** on Time-Saver Card

NOW, SELF-TAPPING MOUNTING SCREWS ENCLOSED IN EACH PACKAGE!

PAUL-MUNROE'S

FILLER-BREATHER

. . . proven-protection for hydraulic system reservoirs. Performs threefold job of breathing, air filtering and straining hydraulic oil as it is added!



MODEL A-100

PRICE LIST: 1 - 4 $4.00 ea. 10 - 24 $3.10 ea. 5 - 9 $3.50 ea. 25 - 49 $2.80 ea. 50 and up $2.60 ea.

To order or for further information wire or write . . .

"Controlled Fluid Horsepower"
PAUL - MUNROE HYDRAULICS
6430 East Gage Avenue
Bell Gardens, California

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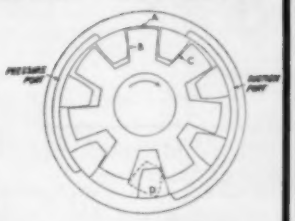
Circle **91** on Time-Saver Card

Kingsbury Slipper Type

HYDRAULIC PUMP

For Pressures to 2000 psi



- **Clearance at "A" eliminates trapping.**
- **Slippers seal at "B" and "C" giving wear compensation.**
- **Slipper pumping at "D" rides on hydrodynamic oil film for minimum friction similar to Kingsbury thrust bearing.**
- **Springs are not required.**

The Kingsbury Slipper Pump is the latest addition to our line of hydraulic equipment for Materials Handling and allied applications which already include:

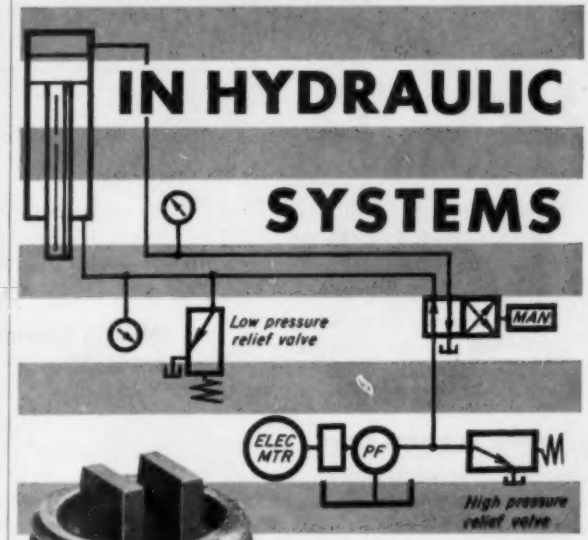
Tog-Oil® double acting, variable leverage hand pumps for pressures to 10,000 psi.

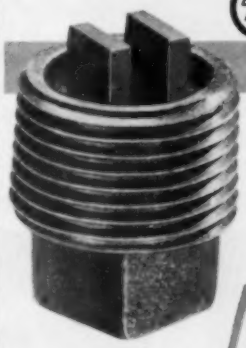
Hydro-Wheel® for self-propelled lifters. Gives 360° steering and reverse operation.

Write Dept. AP-7 **MECHANISMS CO.**

118 East Second Street, Uhrichsville, Ohio

BETTER PERFORMANCE IN HYDRAULIC SYSTEMS





with

LISLE *Magnetic* PLUGS

Numerous tests and user reports prove that Lisle Magnetic Plugs increase the trouble-free service life of hydraulic pumps better than 300%.

Installed in the flow path or sump, the Lisle Magnetic Plug picks up ferrous metal particles circulating in the fluid — preventing unnecessary wear on critical moving parts and eliminating a major cause of fouled valves.

LISLE CORPORATION
CLARINDA IOWA

Write for Catalog and Test Samples.

Circle **83** on Time-Saver Card

Standard *For* Industry

CENTURY Liquid Level SIGHT GAGES

- **Easiest Possible Installation on any wall thickness**
- **Large Face for Better Visibility— 7" Overall**
- **Can be used with non-inflammable oil**
- **Leak-Proof — No Dripping**
- **For Better Service at Lower Costs, Start Using Century Gages Today**
- **Available Immediately — from STOCK**

Send for new catalog containing dimensional information on hydraulic reservoirs and complete line of power unit accessories.

CENTURY HYDRAULICS
Division of CENTURY-DETROIT
6101 Concord Ave. • Detroit 11, Mich.
Telephone: WAlnut 3-8088

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POST SCRIPTS OF INDUSTRY

News about people, manufacturers and sales organizations

Badnoch gets Vickers vice presidency

Ben W. Badenoch, since 1957 general manager of Vickers' Aero Hydraulics Div., was elected a vice president of the company. He joined Vickers in 1949.

Moog appoints Laird

O. Cleveland Laird, Jr., was named sales manager for the Industrial Division of Moog Servocontrols, Inc., East Aurora, N. Y. A mechanical engineer, he will direct the representatives handling the company's industrial products.

Welling elected executive vice president

Commercial Filters Corp., Melrose, Mass., elected Frank W. Welling executive vice president and treasurer. Before joining Commercial in 1959 he served as vice president and director of W. A. Case & Son Mfg. Corp.

Industrial Publishing elects two officers

Lester P. Aurbach

Edwin M. Joseph

Lester P. Aurbach has been elected president and Edwin M. Joseph executive vice president of HYDRAULICS & PNEUMATICS' publisher, The Industrial Publishing Corporation. Aurbach, until now executive vice president of our 30-year old company, recently celebrated his 25th anniversary with the firm. He succeeds Irving B. Hexter who died recently. Aurbach joined The Industrial Publishing Corporation in 1935, was appointed vice president three years later, executive vice president in 1952.

Joseph joined the company in 1945 as general manager of *Occupational Hazards* magazine. He was named a vice president in 1952 and first vice president in 1959.

Taylor represents Berry

Charles R. Taylor announced the establishment of a sales agency representing Berry Hydraulics and manufacturers of associated equipment at 2323 Main Street, Pittsburgh, Pa.

Pippenger appointed director of sales

Double A Products Company, Manchester, Michigan, a wholly owned subsidiary of Brown & Sharpe Mfg. Co., appointed vice president John Pippenger as director of sales. He will be succeeded as chief engineer by Ronald Loup, previously assistant chief engineer. Peter Olmsted will serve as vice president in charge of research and development.

Houghton opens new San Francisco plant

To handle its increasing west coast business, E. F. Houghton & Co. has opened a new plant at 54 Tanforan Ave. Located on a three-acre plot, it includes manufacturing, laboratory, office and outdoor storage facilities.

Walter Norris & Walnor realign, name two

All business formerly handled by Walnor Corp. and Walter Norris Engineering Co., Chicago, is consolidated into one operation, under the latter name. The firm is a factory representative and stocking distributor. Stocking branches,

Continued on page 150

Circle **125** on Time-Saver Card

TubeXperience in action

10 important reasons why Superior SAE Hydraulic Steel Tubing is your best buy

- **Ease in bending and flaring,** with no loss of ductility in storage or service, through use of 0.12% max. carbon content nonaging steel
- **Consistently uniform tubing** through careful inspection of raw material and tubing in process
- **Bright scalefree OD and ID** through controlled atmosphere annealing
- **Smooth ID** by mandrel drawing close to finish size
- **Assured cleanliness** by hot solvent degreasing before all process anneals and shipment
- **Flare-inspected quality** based on 35% increase of OD
- **100% hydrostatic testing** to recommended working pressures
- **Rust preventive treatment** of all tubing before shipment
- **All tubing boxed and wrapped** for cleanliness and to protect against bending and denting during shipment or in warehouse storage
- **A complete range of sizes** stocked and sold by leading steel service centers

FREE! Bulletin 39 which contains bending data, working and bursting pressures, and flow information. Write Superior Tube Company, 2030 Germantown Ave., Norristown, Pa.

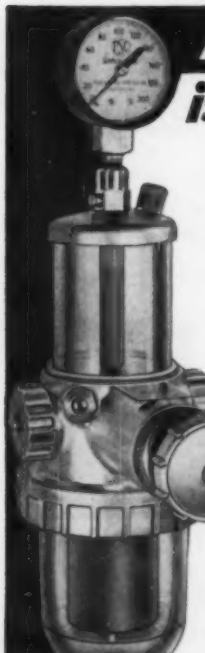
Superior Tube

The big name in small tubing

NORRISTOWN, PA.

All analyses .010 in. to ⅛ in. OD—certain analyses in light walls up to 2½ in. OD

West Coast: Pacific Tube Co., Los Angeles, Calif. • FIRST STEEL TUBE MILL IN THE WEST



AIR CONTROL is Cost Control!

3-Way Air Control

REGULATOR — FILTER — LUBE

Set the regulator to desired pressure . . . adjust the oil metering valve . . . and you are assured **3-way protection** for your pneumatic equipment. The dual-action filter is automatic.

1—REGULATES accurately—automatic bleed-off—serves as a shut-off valve—**reduces costly "set-up" time.**

2—FILTERS out dirt, scale and condensate — dual action — interchangeable filter cartridges — protects against damage due to dirty air — **less "down-time".**

3—LUBRICATES with a penetrating fog-like oily mist — reduces costly repairs and replacement of air tools — **controls costs.**

The easiest to install . . . small, compact and only 2 connections, "in" and "out". Available from stock in ¼"-⅜"-½" and ¾" NPT.

Write for Bulletin 80 describing our COMPLETE LINE of Air Control Devices.

PERFECTING SERVICE CO.

332 Atando Ave. Charlotte, North Carolina

Baltimore - Buffalo - Chicago - Cleveland - Camden - Los Angeles
New York - Providence - Montreal - Toronto - Hamilton, Canada

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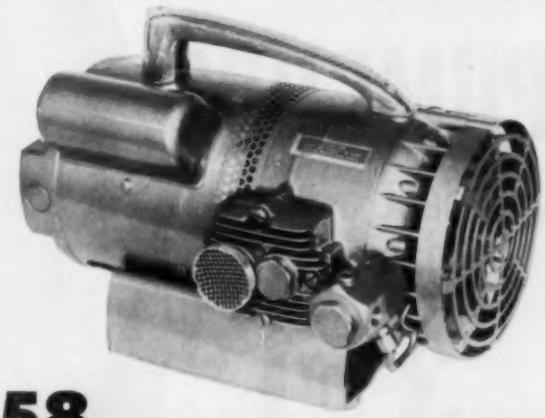
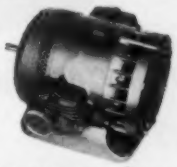
DESIGNERS ARE LEANING TO B&G® *Oil-less* COMPRESSED AIR TO DO MORE JOBS BETTER



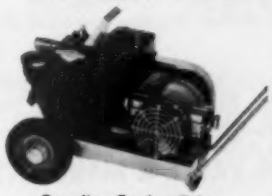
58 MODELS—¼ to 1½ HP—Pressures: to 190 psi. Vacuum: 27.5"—Air displacement: to 13.14 CFM.



Bare compressor (less motor)

10 gallon Air Tank Motor Compressor Outfits

30 gallon Air Tank Motor Compressor Outfits



Gasoline Engine Driven Compressor Outfits

Use of compressed air is rapidly increasing because of its many exclusive advantages as motive power, for process agitation and for energizing intricate mechanical movements. B&G Air Compressors fit ideally into this picture because they are *oil-less!*

There is no chance of oil-spoiled work—*not a drop of oil* can be found in this compact, lightweight compressor. Motor and compressor are permanently grease-packed...carbon-graphite piston rings and skirts operate for years without injury to the cylinder walls. Since the cylinders are not oil lubricated, air is always oil-free—no oil separator needed—no costly lubrication maintenance.

B&G oil-less Compressors are velvet-smooth! Modern design, large bores, short stroke, horizontally opposed pistons provide better balance and vibrationless operation. B&G Compressors are available in a complete line of portable, tank mounted, tankless and gasoline engine driven models.

Send for Catalog GO-259

Oil-less **AIR COMPRESSORS**

BELL & GOSSETT COMPANY

Dept. GG-66, Morton Grove, Illinois

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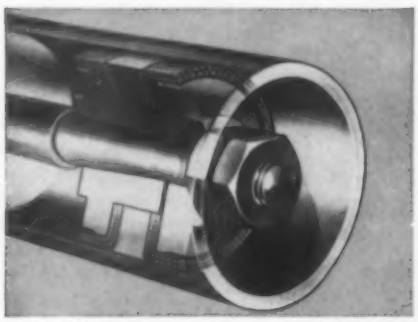
PUMCUPS

outlast ordinary packings

3 TO 1

- *in hydraulic and pneumatic mechanisms*
- *in reciprocating pumps*



With Darcova Pumcups...regardless of wear, pressure keeps Pumcups hugging cylinder wall.

Operating costs go down and efficiency goes up when Darcova Pumcups go in! Here's why:

- **Pumcups outlast other packings at least 3 to 1, based on actual reports from users**
- **Fluid slippage is virtually eliminated, because Pumcups operate at full efficiency throughout their entire life**
- **Maintenance costs are reduced, because you have fewer replacements, less downtime.**

Available in three textures—hard, medium and soft. Also in regular or 100% nylon composition. Size ranges from ¾" to 20". For *all* the facts on Darcova Pumcups, write for Bulletin 5903.

DARLING VALVE & MANUFACTURING CO.
Williamsport 15, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP
TRADE MARK
PUMCUPS

Circle **39** on Time-Saver Card

POST SCRIPTS OF INDUSTRY

including four new ones, are in Chicago, Rockford, Moline, Des Moines, and Cedar Rapids. Walnor Corp. will be activated as a stocking distributor for non-competitive lines. A separate, independent group of Walnor sales engineers will be employed. The two companies will share offices and facilities. Edward C. Rose has been named vice president and sales manager of Norris. Walnor's new vice president is Marvin R. East.

Theodore C. Smith heads Pegasus sales

Pegasus Laboratories, Inc., Berkley, Mich., has promoted Theodore C. Smith from eastern regional sales representative to sales manager.

WABCO names Smith sales manager

Joseph R. Smith has been named sales manager of the Industrial Products Div., Westinghouse Air Brake Co., Wilmerding, Pa. Prior to the appointment, Smith was division sales manager of Miller Fluid Power Div., Flick-Reedy Corp.

Smith

Jupp

Jupp joins Alta Engineering

Garrett Jupp has been appointed field engineer by Alta Engineering Co., Denver, Colorado. A graduate in mechanical engineering and geology, Jupp will assist fluid power users in the oil and mining industries.

Cuno appoints Puglisi

The Cuno Engineering Corp., Meriden, Conn., named S. Joseph Puglisi assistant manager of the sales engineering division. He assumes broad responsibility for operation of the division. He will devote attention to new applications and uses of the company's products.

Chattler becomes general manager

Raymond Atchley, Inc., Subsidiary of American Brake Shoe Co., appointed Leo M. Chattler as general manager.

Snap-Tite creates new sales districts

Western and midwestern sales divisions have been established by Snap-Tite, Inc., Union City, Pa., as the result of a three year study of the company's sales pattern. Tom Welsh has been named sales manager for the new western district, with offices at Encino, Calif.; L. R. Finn was appointed sales manager for the midwestern division, headquarters at Chagrin Falls, Ohio. Harold Fisher succeeds Welsh as eastern division manager, with offices at Manchester, Md.

Greene, Tweed assigns western district rep

Miller

David W. Miller has been appointed district sales representative of the California, Oregon, Washington area for Greene, Tweed & Co., North Wales, Pa. Miller has been with the company for ten years, in 1956 was made sales rep in the Cincinnati area and in 1958 moved to the Chicago territory. He will be in charge of sales and customer service.

WABCO to move Le Roi Division

By late fall, Westinghouse Air Brake Co., will have moved functions of its Le Roi Division to Cleveland and Sidney, Ohio. Fabrication and assembly done in West Allis, Wis., and Greenwich and Cleveland, Ohio, will be done in the new, Sidney plant. West Allis and Greenwich plant machining will be done in Cleveland. The move will increase efficiency and economy, and will allow expansion.

Borje Rosaen forms consulting firm

To serve manufacturers of fluid power equipment, Borje Rosaen has formed his own sales and marketing consultation firm. He was general sales manager of the hydraulic division of Brown & Sharpe Mfg. Co. and Double A Products Co. His offices are located at 1776 E. Nine Mile Rd., Hazel Park, Mich.

Denison assigns two field engineers

Jean A. Chabot and Robert H. Hamilton have been named field

Continued on next page

REPRINTS

The following reprints of special reports which have appeared in HYDRAULICS & PNEUMATICS Magazine are available:

TEMPERATURE CONTROL IN HYDRAULIC SYSTEMS

A complete report on latest developments. Sixteen pages of data on heat generation, fluids and packings, heat dissipation, system design, oil coolers, immersion heaters, and automatic temperature control.

COMPONENTS FOR WATER HYDRAULICS

A special 16-page report covering the design, selection and sizing of pumps, valves, accumulators, packings and cylinders. The report covers also additives and air controls.

WHAT TO LOOK FOR IN AIR VALVES

This 16-page report contains basic designs of directional control, pressure control and flow control valves. Illustrates many different designs and points to remember in selecting a specific design.

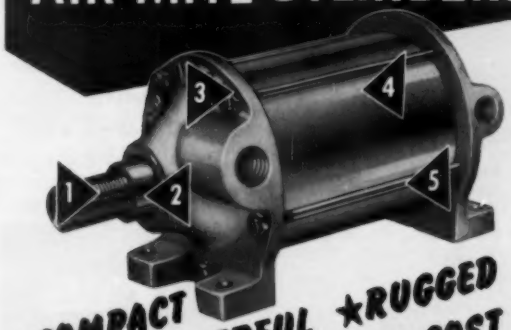
Single copies 50¢; over 50 copies, 35¢ ea.

REVISED JIC HYDRAULIC STANDARDS

Single copy	75c
10 to 24 copies	60c
25 to 49 copies	50c
50 or more copies	40c

Send all orders—enclosing the exact amount in coins or checks—to: HYDRAULICS & PNEUMATICS, 812 Huron Road, Cleveland 15, Ohio.

AIR-MITE AIR CYLINDERS



★COMPACT ★POWERFUL ★RUGGED ★LOW COST

AIR-MITE Cylinders—made in Single or Double Acting Series, in 4 mounting types, are high quality cylinders at a low price. Simple, rugged design and compact construction give them long life, permit easy mounting on jigs, fixtures, tools, or machines. Used wherever power holding, pushing, pulling, or lifting is required, AIR-MITE Cylinders will meet your most exacting requirements of dependability and long life. Write for complete catalog and prices.

QUALITY FEATURES:

1. Ground and polished steel ram
2. Bronze oilless ram bushing
3. High strength aluminum alloy cylinder heads
4. Brass, true-bore cylinders
5. Five steel tie rods

92

AIR-MITE DEVICES, INC.

4101 W. Kinzie St. Chicago 24, Ill.

Circle 4 on Time-Saver Card

Circle 1 on Time-Saver Card

Fall Wiper Ring SPRING LOADED

The Fall "CJ"* Wiper-Scraper Ring is Spring-Loaded causing Squeeze-Grip Action on the O.D. of the piston rod during entire cycle. This patented feature maintains a uniform, continuous pressure on the wiping edge of the ring at all times, stopping any buildup of foreign matter between the ring and the rod.

SQUEEZE GRIP ACTION

It automatically takes up wear, maintaining NEW RING PERFORMANCE. Available in diameters ½" through 13" for any commercial use. AN and MS numbers in use by the Military and Aviation industry since 1944. Manufactured in accordance with MIL-S-5049. (*Closed Joint)

ACE PRODUCTS CO.

1820 N. 12th St. Toledo 1, Ohio

Est. 1935

POST SCRIPTS OF INDUSTRY

engineers for Denison Engineering Div., American Brake Shoe Co., Columbus, Ohio. Chabot, located in Manchester, Conn., will

Chabot

Hamilton

cover Connecticut, Maine, Massachusetts, New Hampshire, upper New York, Rhode Island and Vermont. Hamilton, at Glenside, Pa., covers Delaware, Maryland, southeastern Pennsylvania, Virginia and the District of Columbia.

Versa moved

Versa Products Company, Inc., has moved their factory and offices to new modern facilities at 150 Coolidge Ave., Englewood, N. J.

New distributors

Brady Engine Co. of Houma, Inc., Houma, La., and *Keller Industrial Products, Inc.*, Rochester, N. Y., will distribute industrial hose and reusable hose fittings made by Parker Fittings & Hose Div., Parker-Hannifin Corp., Cleveland, Ohio. *Park City Supply Co.*, Bridgeport, Conn., will distribute these products, and Crown air line units made by Hannifin Co. div., Des Plaines, Illinois. *Clem W. Weston Co.*, New Orleans, La., will handle the Crown line. The O-rings of Parker Seal Co., Cleveland, and Culver City, Calif., will be distributed by *Alta Engineering Co.*, Salt Lake City, Utah. Alta will cover western Colorado, southern Wyoming and Idaho, eastern Nevada, and Utah.

Get Easier, More Accurate Cylinder Speed Control

with **Pneu-Trol®** VALVES IN AIR OR HYDRAULIC USE

2,000 (brass or aluminum) and 5,000 (steel) p.s.i.

Pneu-Trol Valves combine in a short, compact body, a tapered fine thread needle for extremely accurate air or oil flow control and a floating retro ball check, which permits full flow in the opposite direction. Retro ball floats in most sensitive position to seat, requiring only a slight differential pressure to fully open or close it. Check Valve and Needle Valve incorporate single function features of Flow Control Valve. All valves available in 5 female pipe sizes — ⅛" to ¾". Valve bodies are made from brass, aluminum, steel or stainless steel. Attractive Prices — Immediate Delivery.

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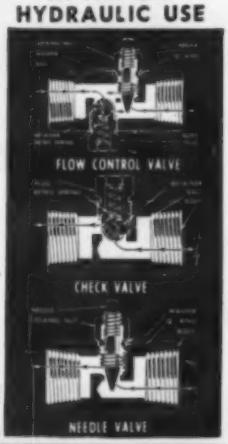
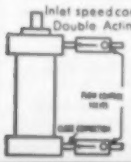


Inlet speed control for Double Acting Cylinder.



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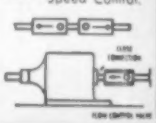

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TRU-SEAL Saves hours in piping installations

PAT. PENDING

Eliminates leaks in oil, air, water, vacuum, chemical lines

Tru-Seal saves hours in assembling piping installations because it enables you to run your pipe lines in any direction you wish, quickly and easily—without having to recut and re-thread piping sections. Wherever used on air, oil, water, steam, vacuum or chemical lines, it seals perfectly at —100° F. to plus 500° F.—*without the use of pipe dope.* Its installation requires only light tightening torque, thus eliminating over-tightening damage to valves, pumps, compressors, and other fittings.

For further information write

TRU-SEAL DIVISION
FLICK-REEDY CORPORATION
7N017 York Rd., Bensenville, Ill.
"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.

1
Thread Tru-Seal on pipe or fitting as far as it will go hand tight.
SEAL SIDE
2
Thread pipe or fitting 3 threads into port. Point in desired direction.
3
Tighten Tru-Seal to complete leakproof assembly (only light torque required).

Circle 131 on Time-Saver Card

Newly organized *Scherer Fluid Power Company*, Royal Oak, Mich., will represent the Hydreco Division, The New York Air Brake Co., in eastern Michigan.

Airtek, Inc., Irwin, Pa., will handle Le Roi S2 stationary compressors, and tank-mounted, unit-type, Westinghouse compressors for Le Roi Div., Westinghouse Air Brake Co., Milwaukee. Airtek will provide accessories and service.

Hanna Engineering Works, Chicago, Ill., has appointed *Hummel Technical Products, Inc.*, as representative in the greater New York City area. *Automation-Sales Engineering Company*, Schenectady, will cover northeastern New York, including the Albany-Schenectady territory.

The Isaacs Company, Cincinnati and Dayton, was appointed by The Wilkerson Corp. for southern Ohio, Indiana, northern Kentucky and the Louisville area.

The Air Flow Company, Inc., Philadelphia, has become zone managing distributor for Wilkerson Corp., Englewood, Colorado, in eastern Pennsylvania, Maryland, Delaware and southern New Jersey.

Robbins Aviation, Inc., Los Angeles, appointed *Stepco* as a distributor for their products. Stepco has offices in El Paso, Texas, Phoenix, Arizona and Albuquerque, New Mexico.

C. L. Boyer & Co., Billings, Montana, is field sales representative for Farris Engineering Corp., Palisades Park, N. J., and Farris Flexible Valve Corp. The Boyer firm covers Montana.

Pneumatic & Hydraulics Company, Baton Rouge, Louisiana, was appointed a stocking distributor by Republic Mfg. Co. Cleveland, Ohio. They will cover Louisiana, southern parts of Alabama and Mississippi.

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LARGE VOLUME STRATOPOWER PUMP

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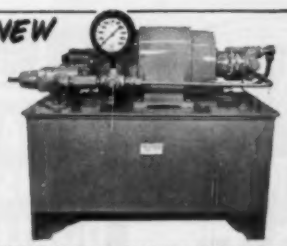

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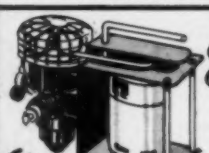
For use in applications where a fast approach to work load is desired. Will deliver combined volume of both pumps (21 GPM), at pressures up to 450 PSI, then delivers output of high pressure pump (4 GPM) at up to 2000 PSI. Both pumps are face mounted on a 5HP, double end, 220/440, 3-phase, 60 cycle AC motor. Mounted on a 33 gal. reservoir (available without reservoir) Size: 35" long x 18½" wide x 18½" high. Other Hi-Lo units available, write for details. Cat. No. DPR-21-1500. Only 625.00



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Consists of a Surplus Cornelius Compressor – combined with a New 1/2 HP, 115/230 V., 60 cycle AC motor; a mounting frame and built-in carrying handle. Pressure tested up to 3000 PSI. Ideal to fill air tanks, laboratory use, etc.

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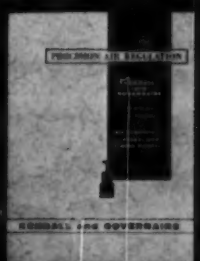

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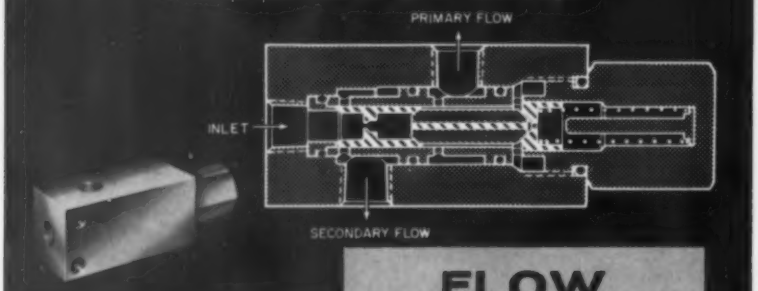

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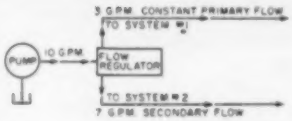

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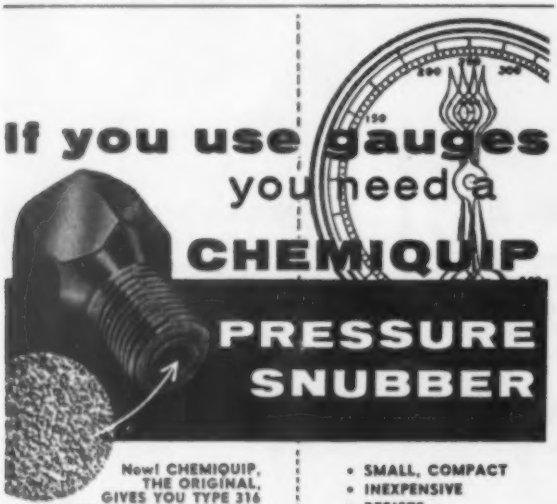

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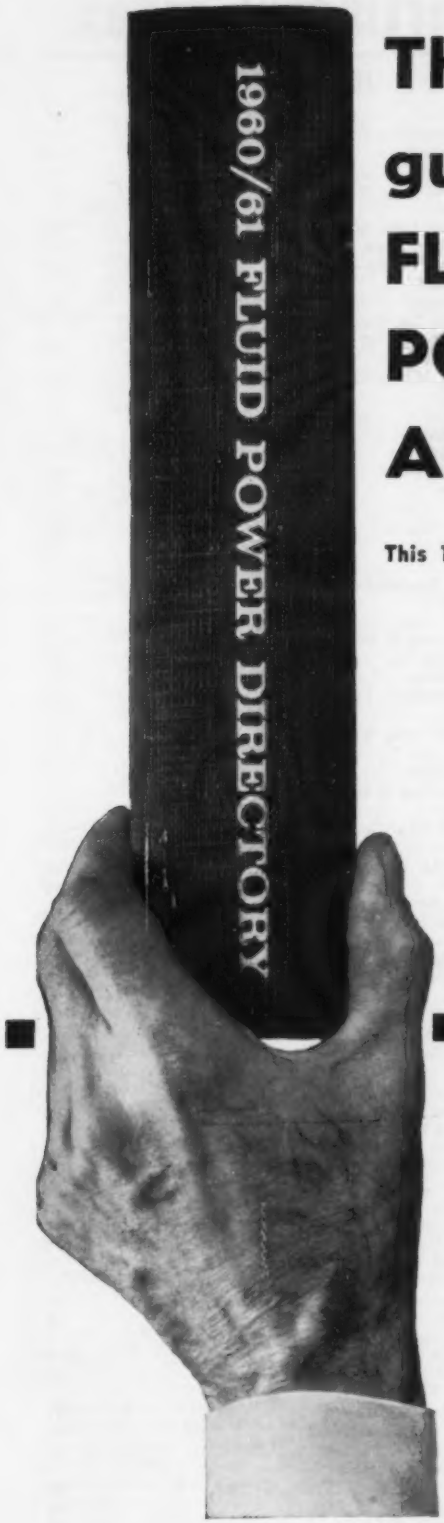

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eliminate unwanted vegetation	kill weeds
It is used to rupture missile frames in flight to initiate aerodynamic distintegration.	It makes missile frames explode in flight.
formation of iron oxide binding the two surfaces	rusted together

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